AUTOMOTIVE INDUSTRIES

LAND — AIR — WATER

AUGUST 1, 1941

FORGET MACHINE "PRIORITIES"... MAKE

PRESENT EQUIPMENT MORE PRODUCTIVE

● WITH your machine tools pushed to capacity, that statement may sound like a pretty large order. But if you haven't thoroughly analyzed your cutting oil needs recently you have a good chance of saving machine time, of getting higher speeds and heavier cuts on these same machines with the right cutting oil. And it won't take a lot of time or money to find out.

Just call in a Standard Oil Engineer. Let him see the type of work you are doing. Give him some of your production figures. When he has made his analysis he'll tell you frankly whether he thinks he can improve them or not.

For example, a Detroit manufacturer asked one of these Engineers for help on a broaching operation. The Engineer's recommendations were a slight change in the broach and the use of Acme Cutting Oil—a highly sulfurized mineral oil for severe work. The results were an increase in broach speed from 18 feet per minute to 20 feet and a 20% reduction in power needed to pull the broach. In addition there was a marked improvement in broach life and in finish.

Call the local Standard Oil (Indiana) office or write 910 South Michigan Avenue, Chicago, Ill. Just say you want a Standard Oil Engineer to analyze your cutting oil needs.

ACME CUTTING OIL

1. Proper Viscosity Grades. *2.* Very Highly Sulfurized. *3.* No Rancidity or Separation. *4.* Non-injurious to Operators and Machines.

STANDARD OIL COMPANY (INDIANA

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AUTOMOTIVE INDUSTRIES
The AUTOMOBILE

Reg. U. S. Pat. Off.
Published Semi-Monthly

Volume 85 Number 3

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Of 8 Oils on Test . . . this One Proved Best

LONGER HOB LIFE is reported by Etco Tool Co. in helping this helical gear, for use in Etco-Emrick Tapping Attachments.

HIGHER SPINDLE SPEED is reported by Etco in machining this Tobin bronze threaded bushing. Texaco Sulfex Cutting Oil used exclusively.

THE ETTCO TOOL CO. of Brooklyn, N. Y., tested 8 different cutting oils to find the brand that would give them longest cutter life, highest spindle speed, finest finish, greatest output.

Of the 8 brands tested, one stood out . . . *TEXACO SULTEX CUTTING OIL.*

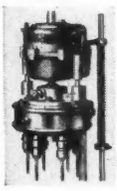
Texaco Sultex assures you of *all* of these benefits because it cools both the cutter and the work, thus preventing chip welding.

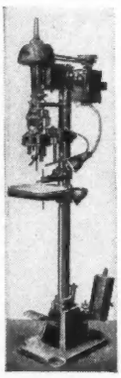
The outstanding performance that has made Texaco preferred in the fields listed in the panel has also made it preferred by prominent machine tool operators everywhere.

These Texaco users enjoy many benefits that can also be yours. A Texaco Engineer specializing in cutting coolants will gladly cooperate . . . just phone the nearest of more than 2300 Texaco distributing plants in the 48 States, or write:

The Texas Company, 135 East 42nd Street, New York, N. Y.

TUNE IN: "Treasury Hour—Millions for Defense." All-Star Radio Program. Every Wednesday Night, CBS. 9:00 E.D.T., 8:00 E.S.T.; 8:00 C.D.T., 7:00 C.S.T.; 6:00 M.S.T.; 5:00 P.S.T.





THEY PREFER TEXACO

★ More locomotives and cars in the U. S. are lubricated with Texaco than with any other brand.

★ More revenue airline miles in the U. S. are flown with Texaco than with any other brand.

★ More buses, more bus lines and more bus-miles are lubricated with Texaco than with any other brand.

★ More stationary Diesel horsepower in the U. S. is lubricated with Texaco than with any other brand.

★ More Diesel horsepower on streamlined trains in the U. S. is lubricated with Texaco than with all other brands combined.

•

ETTCO-EMRICK Tapping Attachments, Multiple Tapping Heads and Tapping Machines *(left)* are precision made . . . *Texaco Sultex Cutting Oil* used throughout.

TEXACO

REG. T.M.

TEXACO Cutting and Soluble Oils

FOR THE METAL WORKING INDUSTRY

IN THIS ISSUE . . .

AUTOMOTIVE INDUSTRIES

Reg. U. S. Pat. Off.

Volume 85 August 1, 1941 Number 3

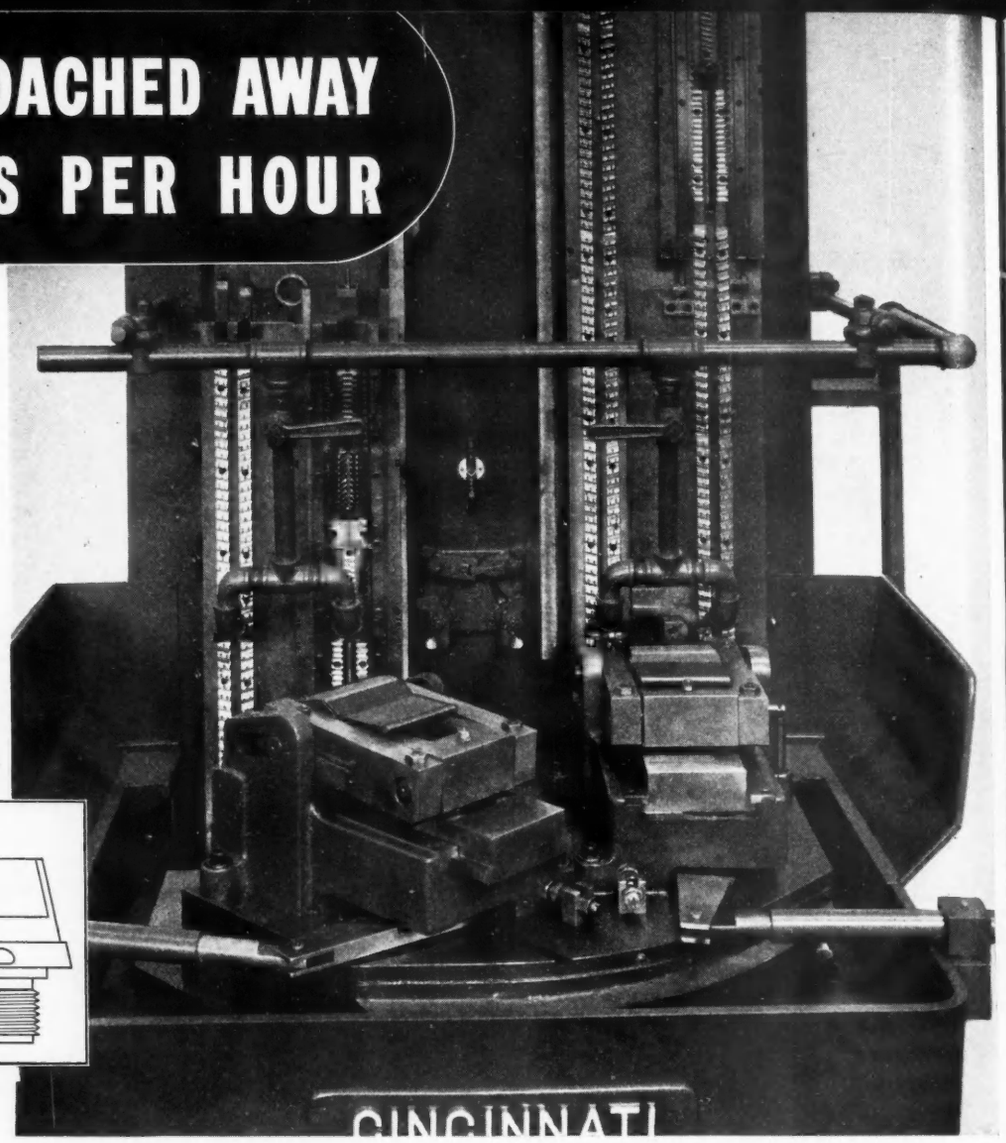
Oil in U. S. Coal Reserves Adequate for 3000 Years

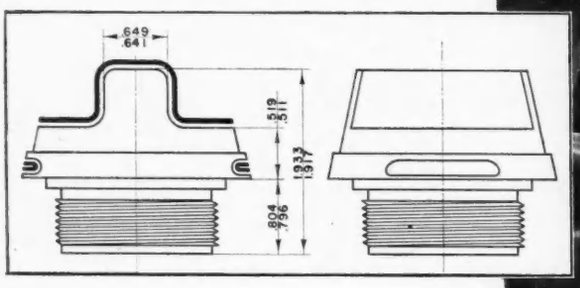
Enough oil for 3000 years at the present rate of consumption could be made from the three trillion tons of U. S. coal reserves. A hydrogenation process developed by the U. S. Bureau of Mines has been tested on 13 different American coals, and has proved that crude oils, similar to crude petroleum, readily can be produced from all the coals tested.

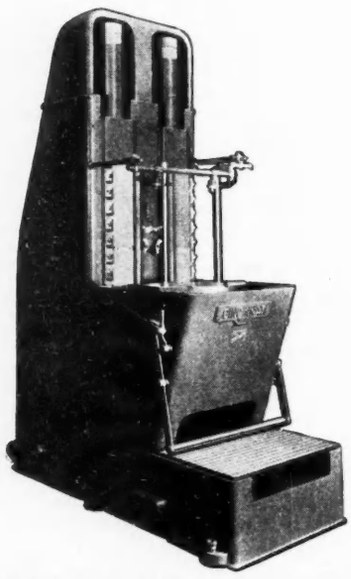
Total potential quantity of oil from America's coal amounts to about 3800-billion barrels, the Bureau reports. From high-volatile bituminous coal down to the poorer quality lignites, yields of crude oil should range from 168 to 78 gal. per ton of coal processed. Average yield from the total coal reserve, however, is estimated at about 50 gal. per ton, to include the quantities of coal used for fuel and power in the processing plants.

Costs of production are known to be considerably greater than the present cost of producing crude petroleum from oil fields. Several European countries, notably Germany, have been using hydrogenation and other processes commercially for a number of years under government subsidy, and are producing large quantities of oil products from coal.

5/8" STOCK BROACHED AWAY ON 306 PARTS PER HOUR







● CINCINNATI No. 5-42 Duplex Hydro-Broach Machine. You may obtain a complete description by writing for catalog M-894.

QUITE often, machine tools have the capacity to perform unusual operations . . . reaching beyond the commonplace run-of-mine job. Today, this trait is more worthy than ever, for production may often be attained by disregarding established procedure.

Broaching machines, for example, ordinarily remove up to 5/32" stock. Greater amounts are usually within the field of other machines. Nevertheless, the equipment illustrated above — a CINCINNATI No. 10-66 Vertical Duplex Hydro-Broaching Machine—removes about four times as much as the conventional stock allowance while maintaining high production.

This machine broaches the tang and two wrench slots on fuse bodies, removing about 5/8" stock, at the rate of 306 per hour.

Two parts are held in each fixture. The total depth of cut is obtained progressively, transferring the part from one side of the fixture where it has been roughed to the other side of the fixture where it is finished. This arrangement produces one finished part each stroke of each ram (two parts per machine cycle).

Perhaps many parts in your shop could be completed more rapidly by the broaching process. Our engineers will be glad to give you their recommendations.

CINCINNATI

THE CINCINNATI MILLING MACHINE CO.
CINCINNATI GRINDERS INCORPORATED

Manufacturers of

Tool Room and Manufacturing Milling Machines
Surface Broaching Machines Centertype Grinding Machines Cutter Sharpening Machines
Centerless Grinding Machines Centerless Lapping Machines

AUTOMOTIVE INDUSTRIES

Published on the 1st and 15th of the month

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August 1, 1941

Mobilizing Men is One Thing, Materials and Machines, Another

By JAMES R. CUSTER

NATIONAL defense is the task of today. The degree of its success depends upon the mobilization of materials, machines and men—the mobilization of materials and machines to produce modern equipment for land, sea and air warfare; the mobilization of men to use it. Everywhere from the Atlantic to the Pacific is this gigantic effort moving forward in a faster tempo from month to month and affecting millions of people in varying ways.

It is well over one year since America started on this road, which must be built—step by step. Much has been accomplisded, yet even more remains ahead. We are beginning to emerge from the blue print stage, in transition to the next page, volume production of the finished products.

Throughout all this undertaking, one fact is obvious—that the industrial mobilization of materials and machines is far different than the military mobilization of men. In the latter case an official order and appeal are effective. In the former, they fall on deaf ears. Materials and machines respond to TOIL AND EXPERIENCE, and only from workers and management capable of giving them. There are no substitutes—no magic words.

Then it is only natural that America has turned to its industrial leaders. Reorganizing the industrial machinery to produce modern war equipment requires time and no amount of wishful pronouncement will achieve it overnight. A mushroom growth presents many pitfalls, some of which might be fatal. If we were late in starting, the concussions due to that failure are not industry's fault. "Witch hunting," such as was injected in the recent aluminum investigation of a Congressional committee, certainly is not helpful.

Instead of coordination and cooperation developing in Washington, rather conflict and confusion have become apparent. There is an example of the results of an abnormal growth. Government defense agencies have been expanded so rapidly that in some cases authority is inadequate, in others overlapping.

In one of the latest conflicts to break into the open, the automobile industry has been placed in the position of receiving conflicting orders as to the amount of production curtailment for the 1942 model year and how it is to be made applicable. And at the time when the industry is ready to start the 1942 production necessary for the adequate maintenance of our vitally needed highway motor transportation. Difficult as the industrial reorganization is, Government defense officials from industry should have full authority and a free hand to get out the greatest possible production of armament and to control non-defense production. Complete reliance must be placed upon their decisions because they are best equipped to make them.

Too much emphasis can not be placed upon the "change over" the automobile industry is undergoing to adjust itself to the defense manufacturing operations. It is a radical change, the greatest in the industry's history. A change in yearly models is a trifle when compared to this switch in products from passenger cars and commercial trucks to aircraft engines, bombers and their parts, machine guns, anti-aircraft guns, gun mounts, airplane propellers, 28-ton tanks, shells, cartridge cases, torpedo tubes, military trucks, reconnaissance cars, and other equipment of highly specialized design.

An instance of what happens when automobile plants are taken over for the manufacture of other products now exists at Buffalo. There the Chevrolet and Fisher Body plants have been closed to retool them for the production of aircraft engines. Automobile engines were built at the Chevrolet plants. Thousands of workers are affected, most of whom have been laid off until operations are resumed early in 1942. They have been notified that "all present employes will be given an opportunity to qualify for work at that time."

In his second quarterly report to the stockholders, Alfred P. Sloan, Jr., General Motors chairman, points to the limitations of the industry's mass production methods and their inflexibility in applying them to the manufacture of military equipment. Of the $1,200,000,000 in defense contracts assigned to General Motors, he states that "due to the requirements for specialized machinery, fully 75 per cent are outside the corporation's normal activities; and 90 per cent are outside the normal area of production of the auto-

(*Turn to page* 74, *please*)

New Set-up for Lycoming

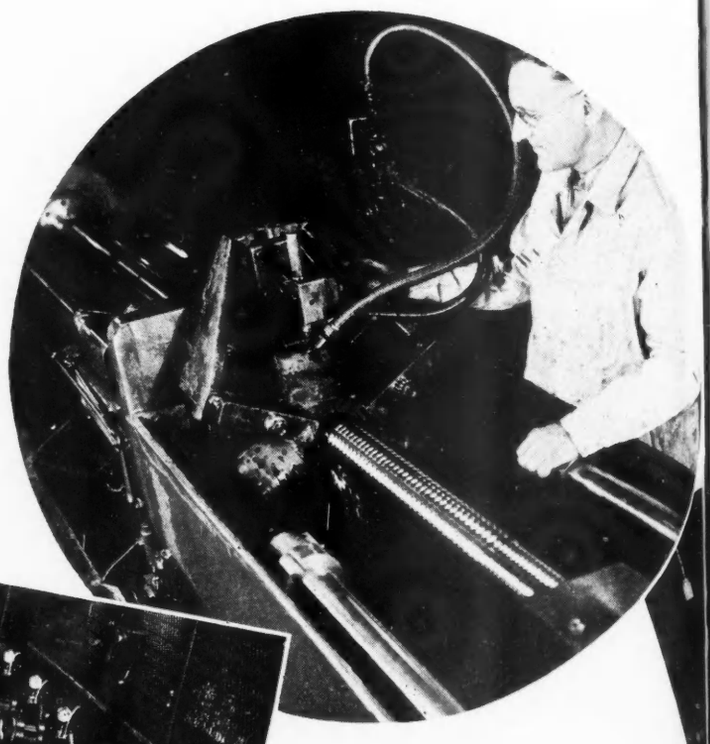
By JOSEPH GESCHELIN

FOLLOWING the pattern of the industry under present day conditions, the Lycoming Division, Aviation Manufacturing Corp., Williamsport, Pa., has devoted most of its productive capacity to national defense work. Major part of this program centers in the production of the Series R-680-E, nine-cylinder radial air-cooled engine of 300 hp. capacity for advance training ships of the Army and Navy.

In addition to the engine building activity, Lycoming also operates a contract shop, serving as a subcontractor for organizations building aircraft engines and parts. Most important contribution along this line is the production of Curtiss propeller hubs.

At the same time, the company is cooperating with the OPM philosophy of spreading work into the many small establishments of the industry by farming out minor components of the radial engine among subcontractors capable of meeting the exacting standards established for military aviation materiel.

The total floor space set apart for national defense work amounts to something in excess of 125,000 sq. ft., is being augmented by additional plant facilities which were under construction when the writer vis-



(Circle) Huge horizontal Colonial broaching machine is employed for broaching operations on the Curtiss hub. One operation is that of spline broaching the hub; the other is broaching the blade sockets.

(Left) Small horizontal engines are run-in on electrically-driven stands after assembly, prior to regular test schedule

Engine Production

ited the plant. The employment roll has risen to 2100 people at the present writing.

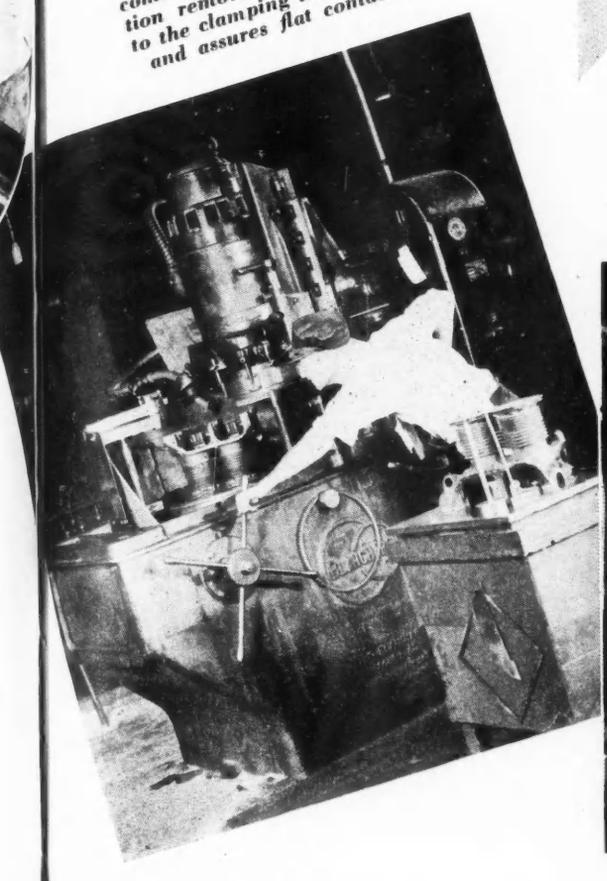
Despite the impact of the national defense program, Lycoming has been able to continue the manufacture of its well-known line of commercial airplane engines by concentrating production facilities in a small self-contained department some 42,000 sq. ft. in area. The current line of small four-cylinder horizontal air-cooled engines of 50 to 75 hp. capacity now has been augmented by the introduction of the new line of four- and six-cylinder horizontally-opposed air-cooled engines rated from 100 to 175 hp. Complete details of the mechanical features of these engines will be found in AUTOMOTIVE INDUSTRIES, March 15, 1941, pp. 332-333.

Meanwhile research and development are carried on apace in the corporation's research division located in Detroit. Just as the motor companies have their proving grounds, Lycoming has its proving ground for the development of experimental engines, for tryout of production engines. For this purpose, they have a fine airport on the outskirts of town, provided with an ample hangar and facilities for mechanical work. Lycoming makes it a practice to purchase planes built by its various customers, is thus enabled to work out the best engine installations, tuning, and flight performance data on each make. Also of interest is the fact that employes have formed flying clubs centering at the airport, laying the groundwork for trained commercial and private flying personnel.

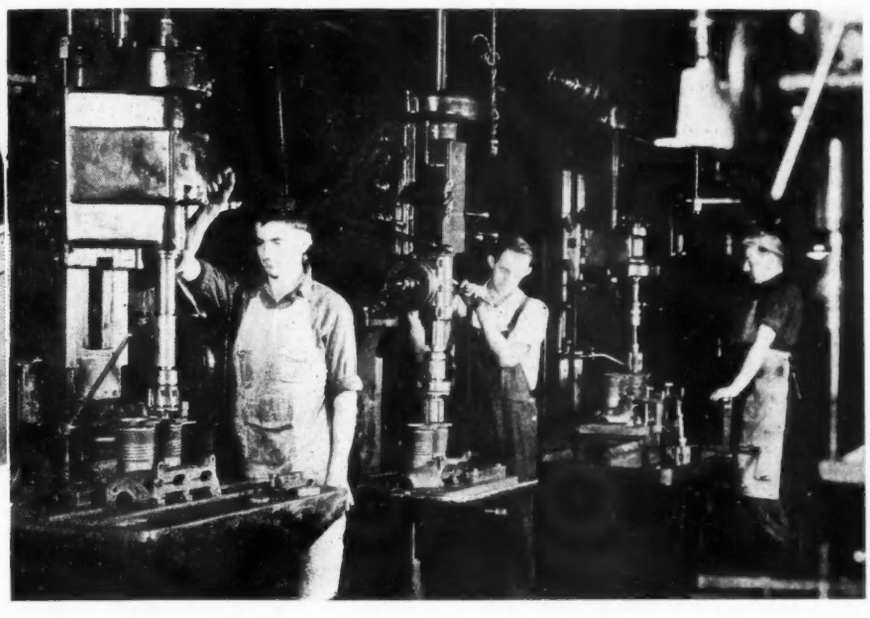
Production set up for radial engines is entirely new, features the items of modern metal

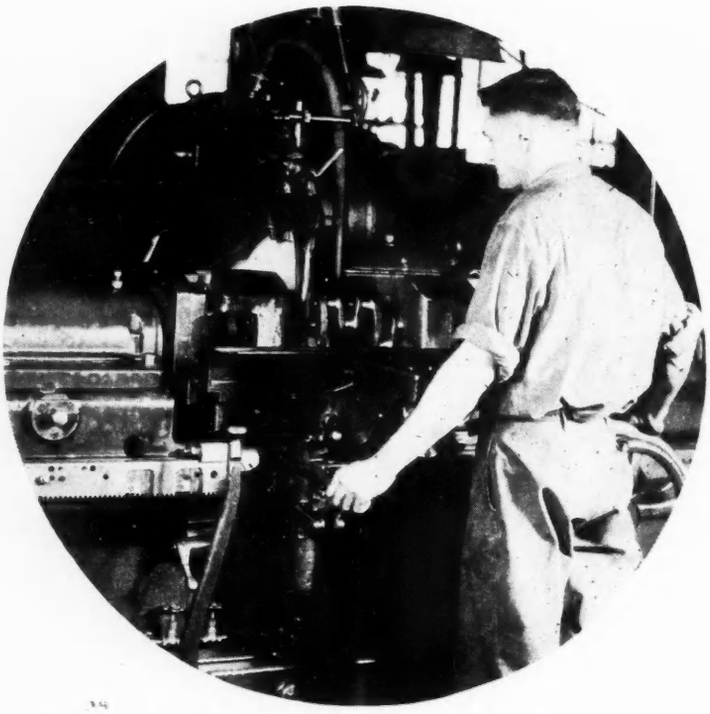
This is the Sixty-second in the series of monthly production features

(Below) Blanchard surface grinder is used for finishing the cylinder contact surfaces on the commercial engine. This operation removes misalignment due to the clamping in metal cutting and assures flat contact faces



(Below) Here is a family of operations for finishing the cylinder barrels of the small commercial engine. At the left is the reaming operation on a Baker heavy duty drill. In the center is a Barnes Drill Co., drill press used for counterboring the top of the barrel. At the extreme right, the barrels are honed on a Moline machine





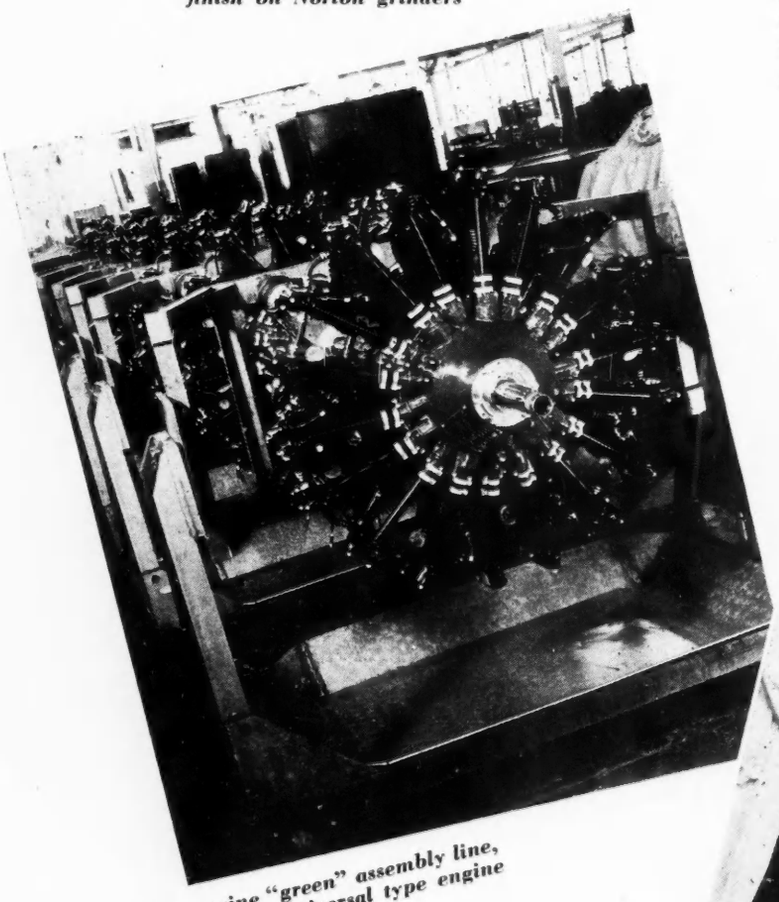
Commercial (light plane) engine crankshaft bearings are ground to precision tolerances and fine finish on Norton grinders

cutting machinery which have become so familiar in similar plants during the past year. High-spotting some of these, we find—Potter & Johnston turret lathes, Warner & Swasey turret lathes, Gisholt Type L high production turret lathe, Ex-Cell-O thread grinders—a must in aircraft engine manufacture, Heald grinders, Norton and Landis external grinders, Bryant chucking grinders, a new horizontal Colonial broaching machine, Cincinnati Hydrotel milling machines, Cincinnati and Kearney and Trecker heavy duty milling machines, Fellows gear shapers, etc.

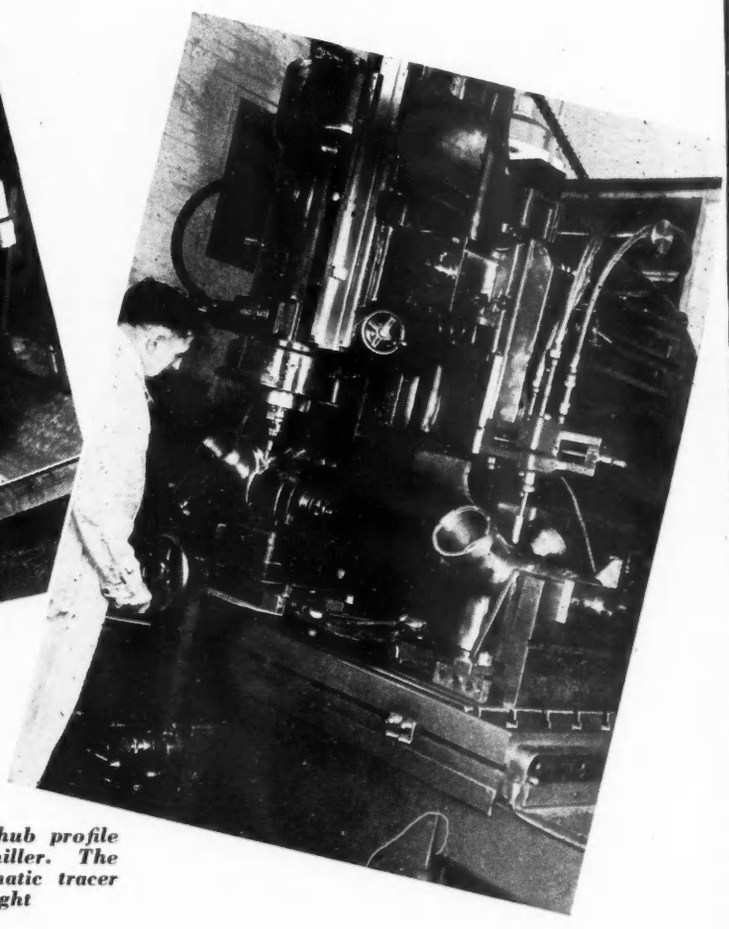
A better sampling of equipment and methods will be found in studying the factory routings of a number of parts selected for this purpose. Too, we have provided an excellent group of illustrations, marking a high-spotting of outstanding operations in every corner of the establishment.

Radical Engine Department

Let us first visualize the simple and effective layout of the machine shop. This is concentrated in a single large area with a wide central aisle running longitudinally. Machine shop departments are laid out on each side of the central aisle with raw materials feeding in from a narrow outer aisle flanking each side. Generally speaking, raw materials come



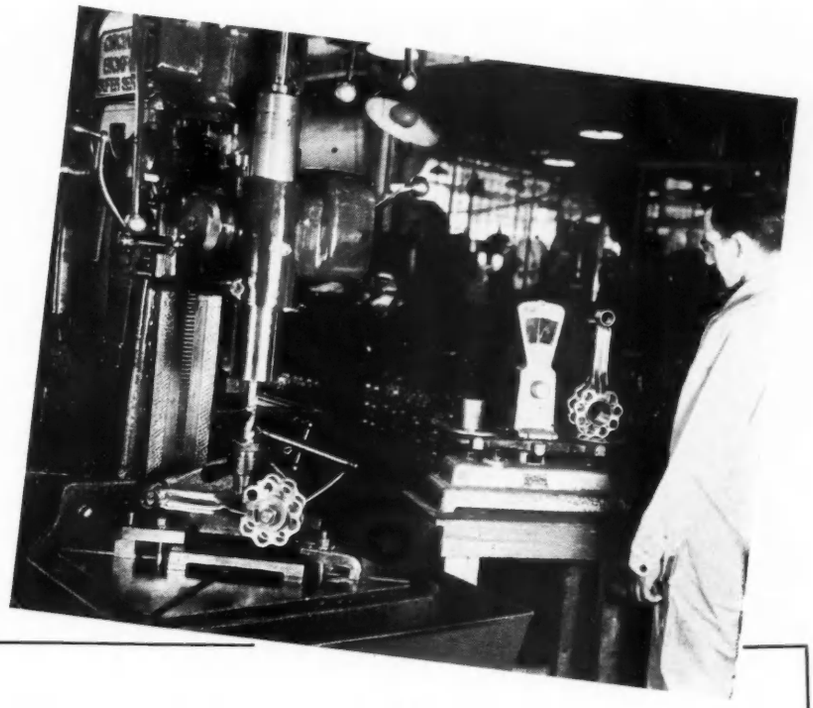
View of radial engine "green" assembly line, showing detail of the universal type engine assembly stands



Roughing out the propeller hub profile on a Cincinnati Hydro-Tel miller. The master form with the automatic tracer may be seen at the right

in from the outer aisle while the finished parts progress to the center aisle, destined for the assembly department at the extreme end.

All component parts are inspected according to the exacting standards of the air services—are checked by Lycoming inspectors, by Army and Navy inspectors. Parts that clear these inspection stages then are checked into the "Bond" room, corresponding to parts stock stores but subject to military supervision. Requisitions for material and parts required by the engine final assem-



Weighing and balance drilling of master rods after machining. A Cincinnati-Bickford drill is used for balance drilling

Factory Routing—Propeller Hub

OPERATION AND EQUIPMENT

SAW off tong hold
Reciprocating hack saw
DRILL ⅝ hole through tong hold
Lodge & Shipley lathe
SAW up tong hold into two test bars
Mill
TURN test bars
Lodge & Shipley lathe
ROUGH DRILL and **BORE** crankshaft hole—rough **TURN** and face rear end—rough cone seat
Bullard V-T-L
Rough **BORE** and **FACE** front end
Bullard V-T-L
Rough **BORE** blade barrels
Warner & Swasey turret lathe
Rough **BORE** and **COUNTERBORE** face and turn outside diameter, form outside contour on blade barrels
Bullard V-T-L
Rough **FORM** between barrels
Cincinnati Hydro-Tel mill
NORMALIZE
HEAT TREAT and quench
DRAW
SAW extra test bar when necessary
MILL
TURN extra test bar
Lodge & Shipley lathe
FINISH TURN and thread extra test bar
Lodge & Shipley lathe
FINISH TURN and thread test bar
Lodge & Shipley lathe
GRIND outside diameter of test bar
Grinder
GRIND out inclusions if necessary (test bar)
Bench
BORE for spline turn and face rear end for location and bore front end
Bullard V-T-L
BROACH spline
Colonial broach
SCRIBE on hub, rough turn and face rear end, rough face and bore front end ½ deep
Lodge & Shipley lathe
BORE front end and form front cone seat and **COUNTERBORE**
Bullard V-T-L
BORE and **COUNTERBORE** rear end and form rear cone seat
Bullard V-T-L
FILE end of splines, rough **GRIND** front and rear cone seats
Bryant internal grinder
SEMI-FINISH TURN front and rear ends and face for location
Lodge & Shipley lathe

OPERATION AND EQUIPMENT

DRILL 3 (¼) holes 3¼ deep from rear ends
Cincinnati radial drill press
DRILL and **REAM** 3 holes from front end
Cincinnati radial drill press
FINISH MACHINE barrels
Bullard V-T-L
TURN diameter front and rear (8-¼)
Lodge & Shipley lathe
FINISH MILL between barrels
Cincinnati Hydro-Tel mill
BROACH 8 slots in each barrel.
Colonial broach
FINISH FACE and **TURN** rear end. **FINISH FACE** front end and chamfer
Lodge & Shipley lathe
FINISH TURN 5.623 diameter and groove
Lodge & Shipley lathe
HAND POLISH
Bench-Kellerflex
GRIND 6¾ diameter in front end
Bryant grinder
MILL 2¼ radius between barrels
Cincinnati vertical mill
DRILL and **TAP** 6 holes in front, **DRILL** one hole
Cincinnati radial drill press
DRILL and **TAP** 6 holes in rear end, **DRILL** and **REAM** 1 hole
Cincinnati radial drill press
FINISH cone seats
Bryant internal grinder
GRIND 5.3167 diameter in barrels
Bryant internal grinder
MILL threads, back off and **MILL** groove
Lees Bradner mill
POLISH bottom of barrels
Kellerflex
BURR
Bench
FILE ends of splines
Bench
INSPECT
Bench
MAGNAFLUX
Magnaflux
POLISH numbers
Bench
FILE radius on inside diameter of 8 slots in ends of each barrel
Bench
BALANCE
FILE radius on outside diameter of barrel and on outside diameter of 8 slots
Bench
FIN BALANCER (Army only)
Bench
CADMIUM PLATE and clean
Cadmium tank

Factory Routing—Master Connecting Rod

OPERATION AND EQUIPMENT

CHUCK rough forging, **DRILL** 2.4845-2.4850 diameter hole, bore and **REAM** to 2.422-2.425 diameter through, turn outside diameter hub on front side, and face side of flange, face end hub
No. 3A Warner & Swasey turret lathe

CLAMP part with the rough side out in fixture, **FACE** end hub on rear side, **TURN** outside diameter of hub, and **FACE** side of flange forming radius in corner
No. 3A Warner & Swasey turret lathe

DRILL 1.3745-1.3755 diameter hole through, **BORE** and **REAM, TURN** outside diameter of hub on rear side, and face "I" section, **FACE** end of hub
No. 4A Warner & Swasey turret lathe

TURN outside diameter of hub on front side and face "I" section, face end of hub, **CHECK** overall length of hub diameter to 1.905-1.915
No. 4A Warner & Swasey turret lathe

DRILL 8—0.9415-0.9420 diameter link pin holes through front flange only, **DRILL** 8—0.9365-0.9370 diameter link pin holes through rear flange only
24 in Cincinnati drill press

ROUGH circular **MILL** link rod slot, **MILL** as far as possible at both ends of cut without cutting into fork at end of "I" section, **FINISH** mill contour of large end, match 1.75 radius at both ends of cut at end of "I" section
No. 3 Cincinnati vertical mill

ROUGH MILL channel and 30 deg. angle in the front side, forming 0.190 radius in corners, hold flange thickness to 0.220-0.225, hold side wall thickness equal
34-48 Cincinnati plain hydro miller with tracer

ROUGH MILL channel in small end, blend with previous cut, hold side wall thicknesses equal
3 KM Kearney & Trecker mill with 2-spindle vertical head

ROUGH MILL side of "I" section, and halfway around small end, repeat operation on other side
34-48 Cincinnati plain hydro with tracer

ROUGH MILL link rod clearance on one side
Cincinnati mill

ROUGH MILL link rod clearance on one side
Cincinnati Hydro-Tel mill

ROUGH trinket **MILL** top and bottom of link rod slot at one side, hold outside edges of cut equi-distant from sides of link rod slot, **ROUGH** trinket **MILL** top and bottom of link rod slot at other side, hold outside edges of cut equi-distant from sides of link rod slot
No. 3 Cincinnati vertical mill

ROUGH MILL center of link rod slot at one side, blend with previous cut, at top and bottom of link rod slot, **ROUGH MILL** center of link rod slot at other side, blend with previous cut at top and bottom of link rod slot
No. 3 Cincinnati vertical mill

DRILL 0.375 diameter hole on centerline at 2.56 diameter
24 in. Cincinnati drill press

HEAT TREAT DRAW SAND BLAST

GRIND spot for Brinell test

BRINELL TEST

BURR for locating as required Bench

BORE and **REAM** to 2.4635-2.4660 diameter through, face end of hub on rear side, turn outside diameter of hub, and **FACE** side of flange forming 0.130 radius in corner, **BORE** groove to size, forming 0.03 radius diameter in corners and to 0.97 diameter from centerline
No. 3A Warner & Swasey turret lathe

FACE end of hub on front side, turn outside diameter of hub and face side of flange forming 0.130 radius in corner
No. 3A Warner & Swasey turret lathe

BORE and **REAM** to 1.354-1.356 diameter
No. 4A Warner & Swasey turret lathe

STRADDLE MILL both ends of hub on small end
No. 2 Cincinnati horizontal mill

FINISH TURN outside diameter hub on rear side and face edges of "I" section, forming radius in corner of hub
No. 4A Warner & Swasey turret lathe

FINISH TURN outside diameter of hub on front side and face edges of "I" section
No. 4A Warner & Swasey turret lathe

FINISH GRIND rear end of hub
Thompson surface grinder

FINISH GRIND front end of hub
Thompson surface grinder

FINISH MILL edges of channel from small end out to flange on large end, repeat operation on the rear side, blend cut with surface at small end
34-48 Cincinnati plain hydro miller with tracer

FINISH MILL side of "I" section, and halfway around small end
34-48 Cincinnati plain hydro miller with tracer

FINISH MILL channel and 30 deg. angle in the front side
34-48 Cincinnati plain hydro miller with tracer.

FINISH MILL channel in small end. Feed along edges toward small end, across end to other side, and back toward large end
No. 3 KM Kearney & Trecker mill with 2-spindle vertical head

FINISH GRIND end hub on front side, **FINISH GRIND** outside diameter hub and **FINISH GRIND** side of flange finish grind 2.4845-2.4850 diameter hole to size
Bryant internal grinder with two wheel spindles

FINISH GRIND outside diameter of hub to size, and finish grind side of flange
Bryant internal grinder with two wheel spindles

FINISH circular **MILL** link rod slot to 1.728-1.732 wide, **MILL** as far as possible at both ends of cut without cutting into fork at end of "I" section
No. 3 Cincinnati vertical mill

FINISH trinket **MILL** top and bottom of link rod slot at one side, hold outside edges of cut equi-distant from sides of link rod slot, **FINISH** trinket **MILL** top and bottom of link rod slot at other side
No. 3 Cincinnati vertical mill

FINISH MILL center of link rod slot at one side. Blend with previous cut at top and bottom of link rod slot. Hold outside edges of cut equi-distant from sides of link rod slot. **REMOVE** part from fixture, put spacer ring on fixture. Clamp part, with front side up, in fixture. **FINISH MILL** center of link rod slot at other side
No. 3 Cincinnati vertical mill

FINISH GRIND 1.3745-1.3755 diameter hole to size
Bryant internal grinder with 2 wheel spindles

Core **DRILL** 8 link pin holes in front flange and 8 link pin holes in rear flange to 29/32 diameter through, **REAM** holes to 0.910-0.915 diameter through
24 in. Cincinnati drill press

DRILL 8 No. 42 (0.0935) diameter holes
Leland-Gifford single spindle drill press

DRILL 4 "I" holes through front flange only, counterbore 4 holes 0.33 diameter, 0.06 deep to size, rough tap four holes, finish tap four holes
Leland-Gifford single spindle drill press

DRILL No. 14 hole at 20 deg. plus 1 deg. minus 1 deg. angle, counterbore 0.265-0.275 diameter to depth shown
Leland-Gifford single spindle drill press

FINISH GRIND inside diameter of eight holes in front flange to size, **FINISH GRIND** inside diameter of eight holes in rear flange to size
Bryant internal grinder

FINISH GRIND front side of link rod slot, **FINISH GRIND** rear side of link rod slot Bench

FORM 0.045-0.055 radius on front end of eight—0.9415-0.9420 diameter holes, form 0.010-0.020 radius on front end of eight 0.9365-0.9370 diameter holes
24 in. Cincinnati drill press

SPOTFACE eight link pin holes
24 in. Cincinnati drill press

POLISH contour of large and small ends, and sides of "I" section
Polishing room, Kellerflex

POLISH channels and edges of "I" section and radius at small end
Polishing room, Kellerflex

POLISH all radii and outside faces of large end
Polishing room, Kellerflex

GRIND clearance on two end link rod holes, and smooth out hub at end of radius
Polishing room, special radius grinder

POLISH hub inside faces, and radii of link rod slot
Polishing room, Kellerflex

BALANCING operation
Smith balancing scales

DRILL hole required
24 in. Cincinnati drill press

BURR Bench

HAND TAP 4—0.3125-24 NF-3 holes, hand **POLISH** inside diameter of link pin, piston pin, and crankshaft holes
Bench

BUFF. Do not brush channels
Polish room

MAGNAFLUX

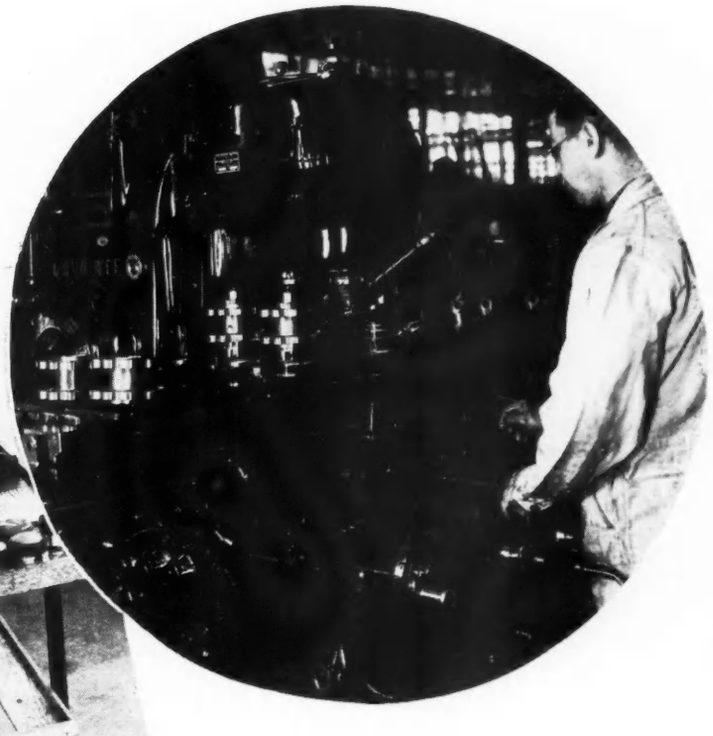
INSPECT Bench

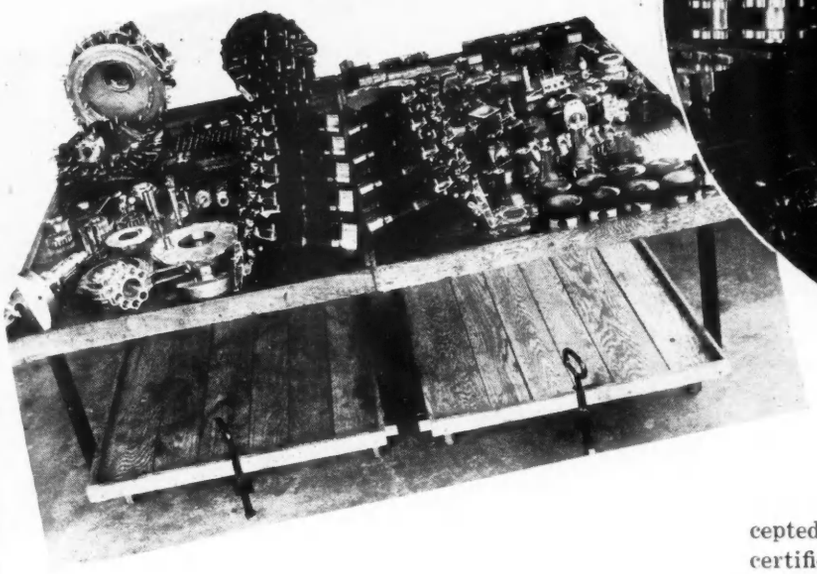
TINPLATE large end Tin bath

INSPECT for tinplating only Bench

(Circle) One of a battery of the new heavy duty Model K Kearney & Trecker milling machines on the master rod line. Here may be seen the operation of forming the master rod shank contour with two pieces at a time held in the fixture

(Below) Lycoming radial aircraft engines are torn down completely for inspection after the routine test run. This shows the component parts laid out on the table ready for re-assembly after Army OK





bly department are filed exclusively from the "Bond" room. Needless to say, this procedure safeguards the quality of every item that enters into an engine assembly.

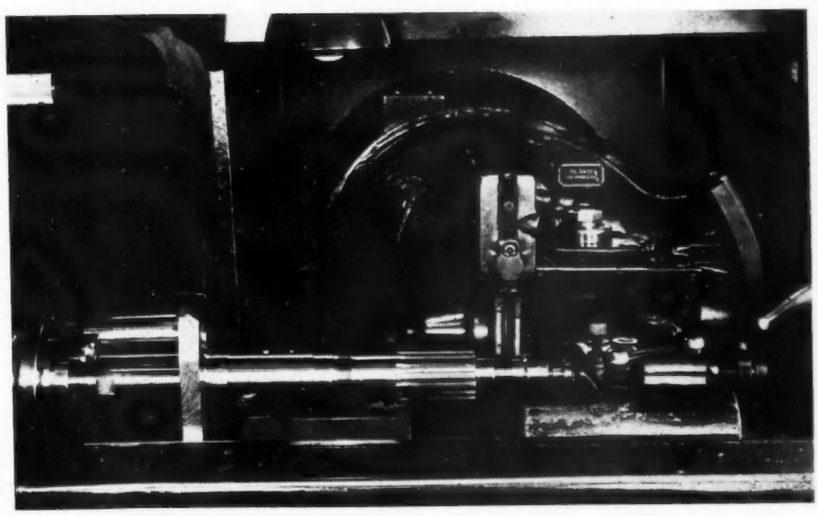
Among the parts fabricated in the machine shops are the following—cylinder barrels, crankshafts, cams, link rods, master rods, cylinder heads, rocker arms, pistons, front housings, crankcase, accessory housing, and all gears. Certain small parts and accessory items are purchased from sub-contractors. These are subjected to the same inspection procedure before they are checked into the "Bond" room.

Radial engine assembly follows conventional aircraft practice with a straight line assembly for the "green" assembly. A bank of twelve test cells are provided for the specified test schedule, so arranged that one operator takes care of two cells from an isolated gallery connecting each bank. After completion of the test schedule, the engines go back to the assembly department for tear-down, degreasing and cleaning, followed by a 100 per cent detail inspection of each individual part.

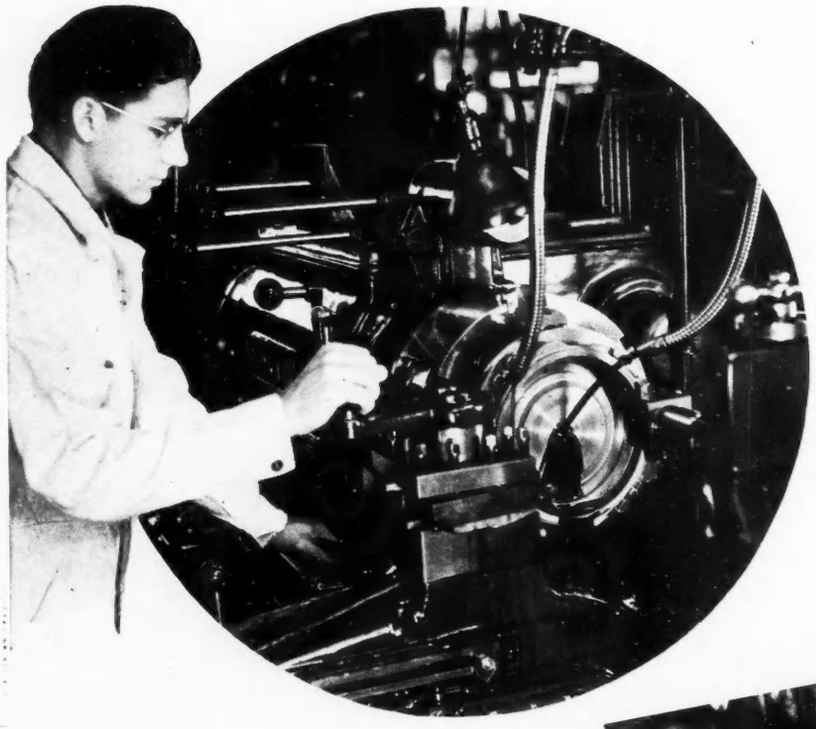
After the tear-down inspection, accepted units are re-assembled on another line, and certified for shipment by Army or Navy inspectors, depending upon their destination.

Apart from the mechanical inspection devices and gages of various kinds, all of the highly stressed major components also are subjected to the now well-known Magnaflux test to assure freedom from minute imperfections which might develop foci for incipient fatigue failure. Among the parts which must pass the Magnaflux test are—rocker arms, crankshafts, cams, and piston pins.

Coming to the actual details of some of the major operations, we refer you to the routings of the crankshaft, crankcase and master rod, condensed in tabular form in the interest of space economy. These routings



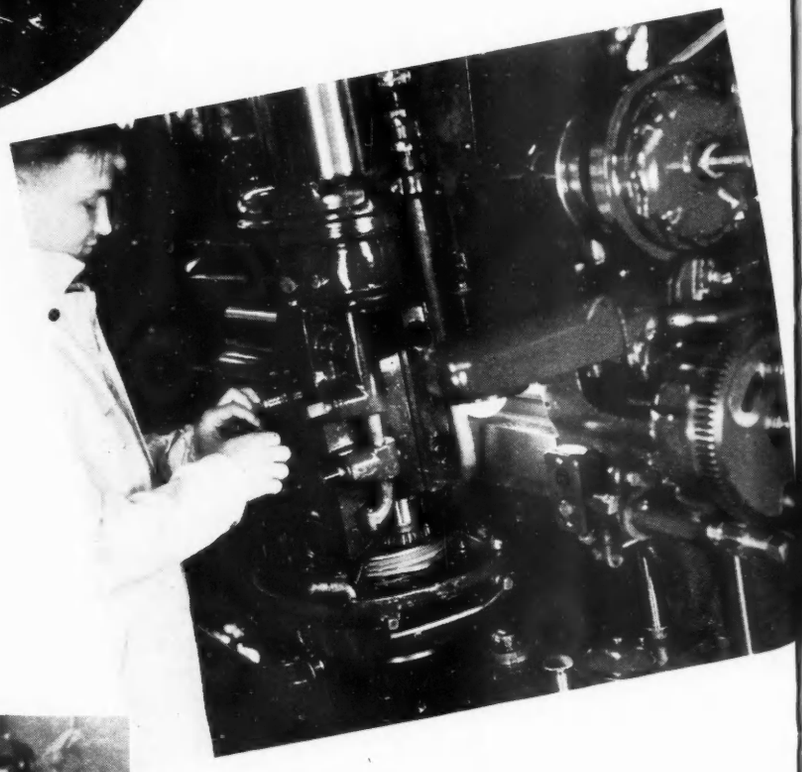
Close-up of the work station of one of the new Ex-Cell-O thread grinders, producing the thread on the end of the radial engine crankshaft

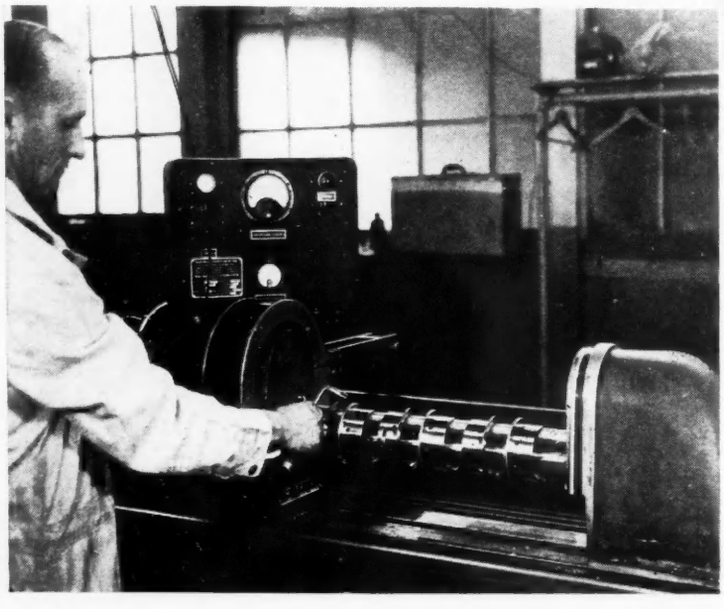


(Above) Gisholt Type L high production turret lathe rough boring the cam ring

(Right) One of the new Fellows gear shapers cutting the internal gear teeth of the cam ring

(Below) Magnaflux machine is used for checking many items going into the radial engine. This view shows the testing of bearing shells





are self-explanatory and require no further comment.

The lobed cam ring is an interesting part to produce, although it requires relatively few operational steps. It starts as a rough alloy steel forging, sand-blasted before going to the Gisholt high production turret lathe, where the I.D. is rough-bored to establish the location for the milling of the lobes. The lobes are milled to form on a No. 3 Cincinnati vertical mill, then copper plated. Lobes now are rough ground on a Cincinnati cam grinder, washed and carburized.

Next follow two Warner & Swasey operations—rough turning the sides of lobes, face boring, forming a recess; rough facing the back side of the bore and undercutting. The cams then go to heat treat, followed by sand blasting in a Pangborn booth. The previous roughing operations on the W & S lathes are finished in analagous steps on another group of W & S lathes.

Gear teeth now are cut on Fellows gear shapers, and a series of 20 holes drilled and countersunk on an Avey drill. The final operation is that of surface grinding one side on a Pratt & Whitney surface grinder, burring the gear teeth, holes, and the I.D.

The master rod is an excellent example of the specialized metal cutting operations required in aircraft engine practice. For the preparatory facing, turning, and boring operations, the forgings are routed over four different set-ups in Warner & Swasey turret lathes—chucking in special jaws on the first machine, held in fixtures for the other three stages. Held in a jig, the rod then is drilled for the eight link rod holes on a 24 in. Cincinnati drill press, taking first the holes in the front flange, then reversing the jig and drilling the rear flange.

Next are a series of milling machine operations on plain milling machines, milling machines with tracer attachments, and Cincinnati Hydrotel mills, which in successive steps produce the final forms and contours of the finished rod. In all the rod requires a total of 60 individual steps from the rough forging to the finished state. A summary of these operations will be found on the routing reproduced elsewhere.

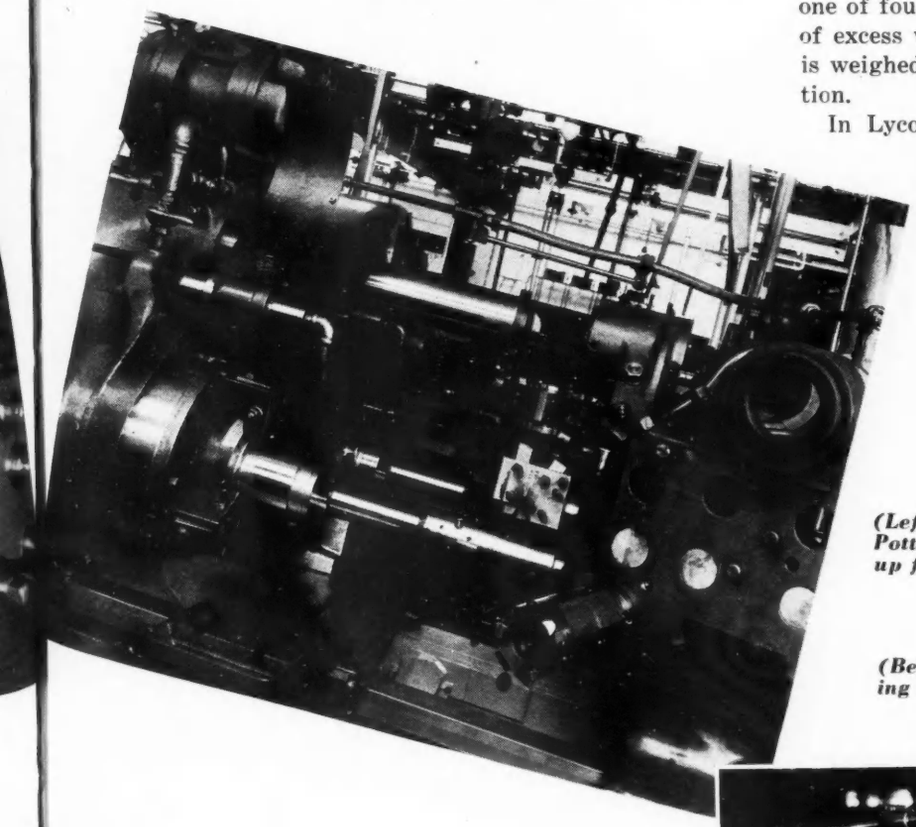
To indicate the general scheme of milling operations on the master rod, we have selected at random one of the steps on a 34-48 Cincinnati plain Hydromatic miller with tracer attachment. The operation—the 30th in the sequence—is that of finish-milling the side of the "I" section and half way around the small end of the rod. A rod is clamped in the first of two fixtures with the front side toward the front of the machine. The operation then is started. While this is taking place, another rod is clamped in the second fixture and the same operation is repeated. As each cut is completed, first the first rod, then the second rod, is removed from the fixture and reversed in position so that the opposite side is milled.

That is about the pattern of individual milling operations, since the rod is symmetrical and takes the same procedure from side to side and end to end.

Balance weighing procedure on the master rod is a rather interesting operation, greatly simplified through experience. The job is done in the polishing room, using Smith balancing scales. The rod is placed on one side of the scale and is balanced by two standard weights—one marked "6.080," the other "0.13"—in the other pan. The pointer dial deflection determines the amount of weight to be removed.

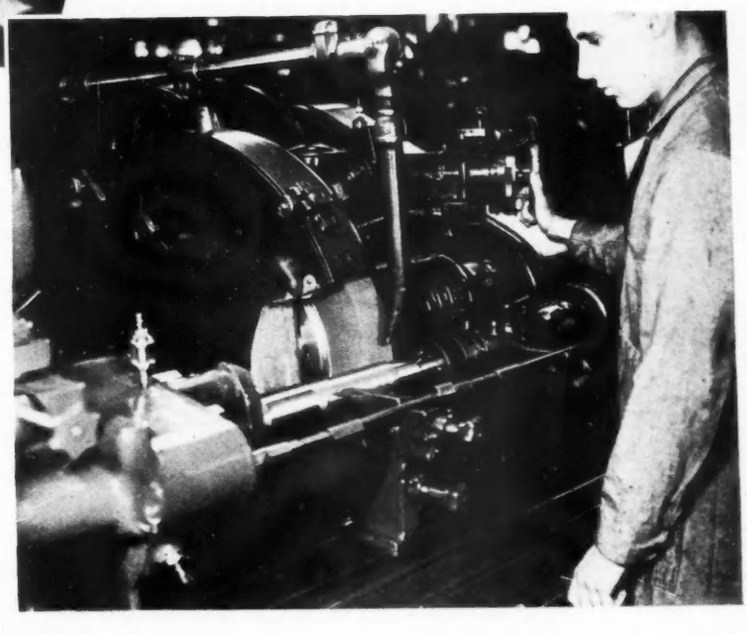
After weighing, the rod is clamped in a drilling jig with the rear side out, on a Cincinnati drill press, and one of four drill sizes is used, depending upon amount of excess weight to be removed. The drilled rod then is weighed again to assure the accuracy of the operation.

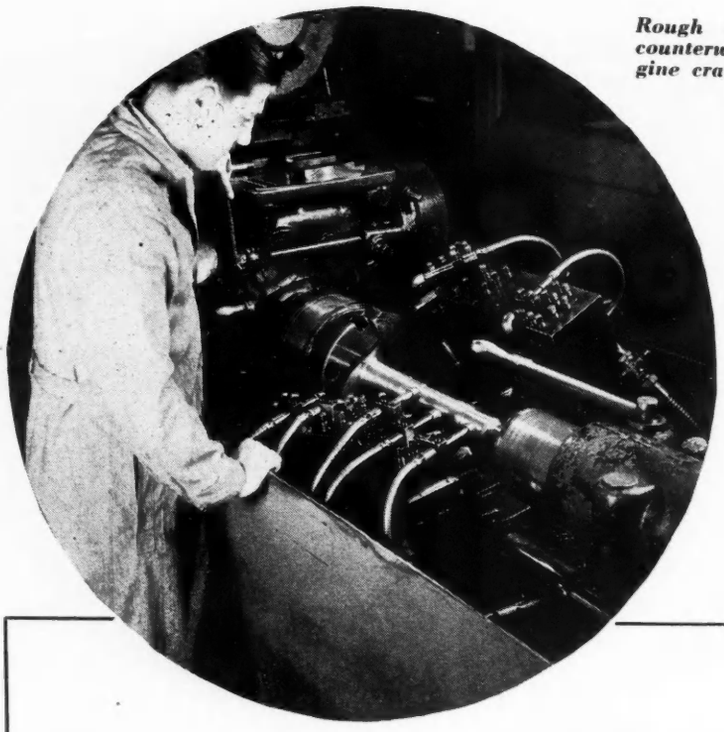
In Lycoming practice, various determining operations on the cylinder head and barrel are completed after the two parts have been assembled. For assembly the head is heated in an oven held at a temperature of 600 to 650 deg. Fahr. The valve seats and spark plug bushings are pressed in first, then the cylinder barrel is screwed home. This is followed by pressing-in of the intake and exhaust valve guides and



(Left) Close-up of the tooling of the two-spindle Potter & Johnston 5-D2L automatic turret lathe set up for boring, turning and facing the cylinder barrel in two chuckings

(Below) One of the radial engine crankshaft grinding operations on the Landis grinder. Norton grinders also are employed on this part





Rough turning bearings and counterweight of the radial engine crankshaft on a Fay automatic lathe

two bushings. The assembly is water tested with hot water at a pressure of 450 psi. Now comes the special machining operations. First is the drilling of 8 flange holes in the barrel, then the milling of flats on both sides, burring, and finally degreasing in a Detrex machine preparatory to spraying with a special enamel.

Spark plug holes are spot-faced and tapped on a Bakewell tapper, dowel holes are drilled in the spark plug bushings, flange holes back spot-faced on a Heald grinder with a special fixture. The rocker box face is finish-milled on a Cincinnati milling machine, the cylinder bore is finish-honed on a Moline machine fit-

Factory Routing Commercial Engine Crankcase (Right Hand)

OPERATION AND EQUIPMENT

CLEAN sand from inside block
PAINT inside of block
Booth
MILL contact face
Cincinnati mill
MILL cylinder contact face
Cincinnati mill
DRILL contact face
Baush drill
REAM locator holes
FINISH MILL contact faces and head
Milwaukee mill (Kearney & Trecker)
Rough and finish **BORE** barrel
Moline Hole Hog
MILL cover side
Cincinnati mill
MILL rear end
Cincinnati mill
MILL oil sump side
Cincinnati mill
STRADDLE MILL main bearings
Cincinnati mill
CORE DRILL cam holes for clearance
Rough and semi-finish **BORE** crank and cam holes rough **BORE** front end
DRILL tappet holes
Baush drill
COUNTERBORE and open up clearance hole spotface bolt bosses in the clear and **COUNTERSINK**
COUNTERBORE and **CORE DRILL** bolt holes
End **REAM** tappet holes
CHECK head clearance for tappets, **HAND REAM** 4 tappet holes
Bench
DRILL cylinder head holes
Natco multi-drill
DRILL cover side
Baush drill
DRILL sump holes
Baush drill
DRILL rear end
Natco multi-drill
TAP cover holes, oil pan side rear end and contact face
Carlton radial drill
DRILL drain back hole
BORE, COUNTERSINK, and **REAM** oil gauge and breather hole
American radial drill
DRILL 7/64 hole across breather hole
Bench
DRILL angular holes in cam bore and form crank to dam
Carlton radial drill

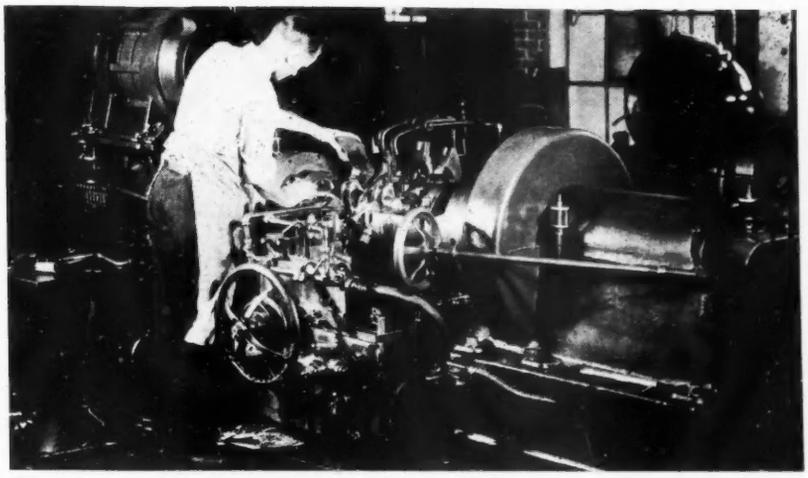
OPERATION AND EQUIPMENT

CUT bearing lock slots in crank and cam bore
Carlton radial drill
MILL oil seal slots
Milwaukee mill
Back **SPOTFACE** cylinder head holes
Aurora drill
GRIND tool clearance on boss below barrel
Bench
REAM barrels
Foote-Burt drilling machine
BREAK CORNERS of bottom of barrel with hand tool
Bench
COUNTERBORE and **BEVEL** for cylinder head
Barnes Drill Co. drill
SERRATE top with hand tool
Bench
LAP barrels
Moline Hole Hog
ASSEMBLE cases and line ream crank and cam bores and front end
Rockford horizontal drill
Rough and finish **BORE** oil seal diameter and **CHAMFER,** finish **FACE** front crank bore and thrust on rear
Aurora drill
DRILL and **REAM** 2 dowel holes in rear end, **DRILL** oil hole
Carlton radial drill
GRIND and blend assembly for enamel, check nut clear
Bench
DRILL 2 angular oil holes in front end
Bench
STAMP and dis-assemble
Bench
DRILL 2 oil hole extensions
Aurora
FILE and **SCRAPE** all sharp corners
Bench
MILL first thrust bearing
Milwaukee mill
MILL second thrust bearing
Milwaukee mill
CHAMFER thrust bearing and grind clearance
Bench
DRILL and **COUNTERDRILL** and tap long oil hole
American radial drill
DRILL 3/16 angular oil hole
Carlton
GRIND counterweight clearance
HAND TAP 6 holes and gauge one
PAINT and bake enamel

ted with Micromatic hones. Exhaust and intake valve guides are reamed, then the valves are ground in Hall valve seat grinding machines.

Following the machining operations, the assembly is washed and is subjected to a variety of bench operations to remove excess paint, drive dowels and studs, hand ream rocker pin holes, hand tap spark plug holes, face rocker boxes, etc. The assembly is again washed, inspected 100 per cent for acceptance.

Of interest to production men is the set-up and tooling for machining the cylinder barrel on a Potter & Johnston two - spindle automatic chucking and turning machine. We



Commercial engine crankshaft rod bearings are turned on Wickes crankshaft lathes—one taking the No. 1 and 4, the other taking No. 2 and 5

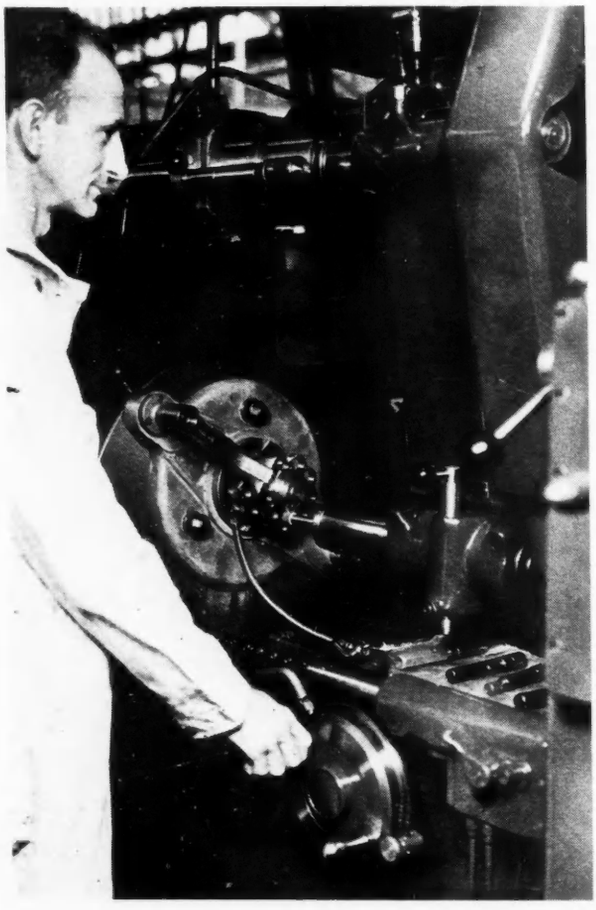
Factory Routing Radial Engine Crankshaft

OPERATION AND EQUIPMENT

MILL to length
Cincinnati Duplex Hydro mill
MILL pin to length
Cincinnati Duplex Hydro mill
STRADDLE MILL both ends of counterweight
Cincinnati Duplex Hydro mill
Center **DRILL** both ends
24 in. Cincinnati single spindle drill
ROUGH TURN bearings and counterweight radius
Fay automatic lathe
GRIND one end bearing for location to 2.125 diameter
Norton external grinder
ROUGH GRIND cam ring bearing
Landis grinder
ROUGH MILL both sides of counterweight
24 in. Cincinnati duplex automatic mill
ROUGH MILL both sides of crank cheek
24 in. Cincinnati duplex automatic mill
Semi-finish **TURN** crank pin. Drill "H" 0.266 diameter hole. Rough and finish **REAM** ¾ radius
No. 4 Warner & Swasey
DRILL rough, and finish **REAM** and form thread seat in rear side
No. 3A Warner & Swasey
DRILL, BORE, rough and finish **REAM** front side. True up center on crank pin end
No. 3A Warner & Swasey
American lathe
Semi-finish **TURN** bearings to grinding size
Fay automatic lathe
FINISH MILL both sides of counterweight
24 in. Cincinnati hydro duplex mill
FINISH MILL both sides of crank cheek
24 in. Cincinnati duplex automatic mill
FINISH MILL 25 deg. angle and radius over top
Cincinnati hydro duplex mill
FINISH MILL 30 deg. flat
36 in. Cincinnati duplex mill
DRILL 37 deg. angle hole
24 in. Cincinnati single spindle drill
FINISH MILL rear end of counterweight
Cincinnati hydro mill
FINISH MILL rear of crank cheek to meet finish diameter turned on turret lathe
Cincinnati duplex mill
WASH
LAP 2 center on small end
Bench
GRIND crank cheek and 1/16 radius in bearing collar
Norton grinder
GRIND main bearing
Landis grinder
GRIND thrust bearing
Landis grinder
CUT internal thread
Hall planetary mill
GRIND cam ring bearing
Norton grinder

OPERATION AND EQUIPMENT

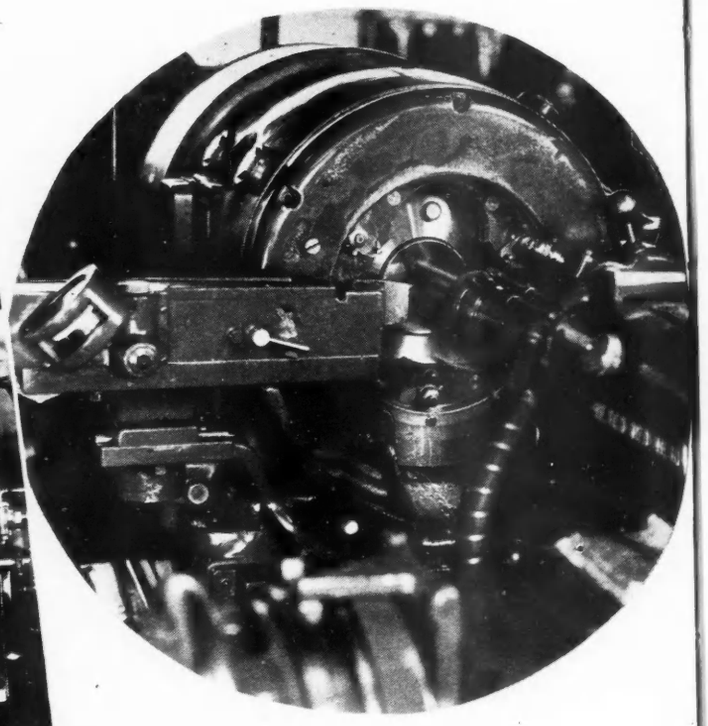
GRIND propeller hub bearing
Landis grinder
Relief **GRIND** propeller bearing
Norton grinder
GRIND propeller hub nut bearing, and 2.057 thread bearing
Landis grinder
Finish **GRIND** 1 15/16 diameter
Norton grinder
Rough **GRIND** crank pin
DRILL lightening hole in crankpin
24 in. Cincinnati drill press
FORM radius and ream lightening hole in crankpin
24 in. Cincinnati drill press
CHAMFER lightening hole in crankpin 45 deg. Chamfer lightening hole in crankpin 30 deg.
24 in. Cincinnati drill press
WASH
CUT and **POLISH** chamfer
GRIND crankpin bearing and ream crankshaft bearing—grind undercut
Landis external grinder
GRIND short end to length and **FILE** chamfer
Cincinnati external grinder
DRILL 1 hole, drill, **REAM** and **COUNTERSINK** 3 holes, drill, double counterbore, and tap 1 hole
24 in. Cincinnati single spindle drill press
DRILL 8 cotter key holes
24 in. Cincinnati single spindle drill press
Rough and finish **CUT** spline, **BURR** splines, and **CHAMFER** sides
Gould & Eberhardt hobbing machine
WASH
CUT .13 undercut and chamber
GRIND bearing retainer nut thread, **GRIND** center thread
Ex-Cell-O thread grinder
GRIND propeller nut thread
No. 35 Ex-Cell-O thread grinder
BACK OFF incomplete thread of propeller nut thread
No. 35 Ex-Cell-O thread grinder
MILL keyway
Kent Owen hand mill
MILL pinch bolt groove
Kent Owen hand mill
WASH
BURR, CLEAN, polish **GRIND,** tool marks from oil seal hole on crank pin end, mount tube in pin end, **GRIND** lightening hole and polish ⅞ clamp bolt groove, **FINISH CUT** seats for oil seal
Bench—Kellerflex
LAP crankpin bearing to fit bushing
Cincinnati grinder
POLISH all over
MAGNAFLUX inspect
Bench
WASH
INSPECT
Bench

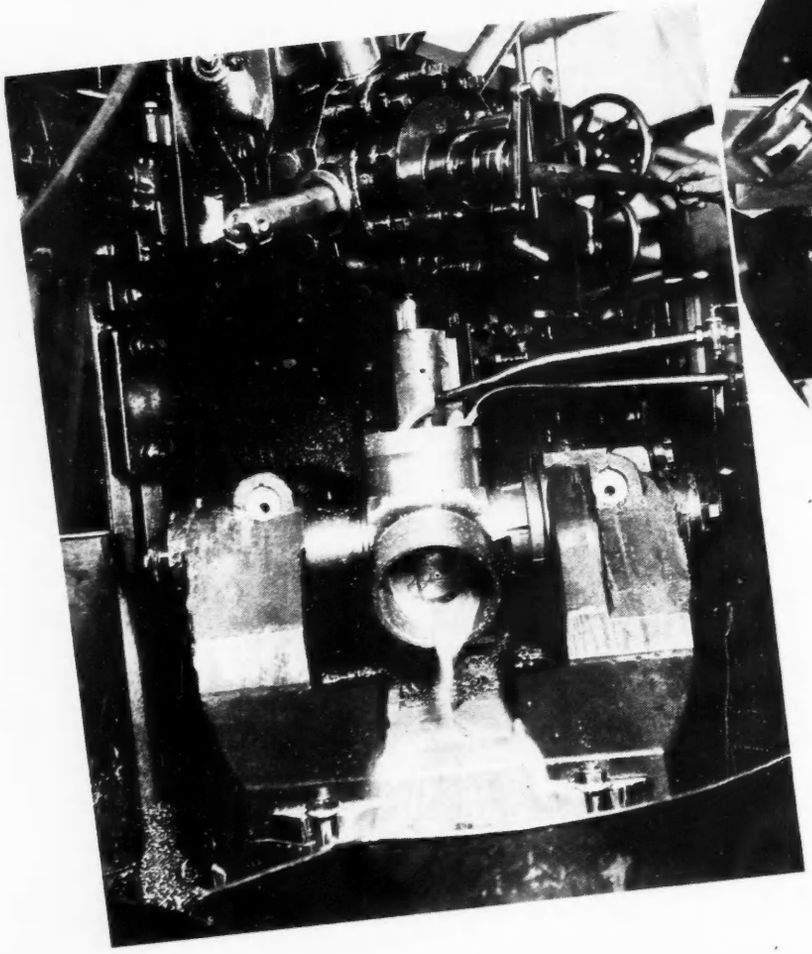


direct attention, particularly, to the rigidity of the equipment, its flexibility of operation, and the ability to handle the entire series of operations from the rough forging to the finish-machined stage in the one machine. Finning and threading are separate operations on other types of equipment, as is customary.

The machine is equipped with an extremely rigid type of overhead pilot in the form of a large diameter, centrally located, hardened and ground steel bar mounted on the headstock which enters bushings of like material in the holders on the individual turret faces. This construction effectually ties the headstock and turret units together while all heavy cuts are being taken.

The tooling for the first or internal operation is mounted on the turret in alignment with the rear spindle, while those tools needed for the second or external operation are in alignment with the front spindle. The two holdings (one on each subject) are performed simultaneously. A three-jaw air chuck is used on the rear spindle, while an air-operated fixture





(Top) Bryant internal grinder—finish-grinding eight link rod holes in front and rear flanges in two settings

(Circle) Heald internal grinder set up for grinding the I.D. of the cylinder barrel

(Left) Finishing the Curtiss hub blade barrels on one of a battery of Bullard V-T-L machines—boring, counterboring, turning O.D., forming contour, etc.

Factory Routing—Radial Engine Crankcase

OPERATION AND EQUIPMENT
Rough and finish **FACE** bore 14.752 diameter to 14.735-14.749 diameter. Finish bore 10.980-19-980 diameter and form radius in front side, rough bore bearing hole No. 3A Warner & Swasey
Rough and finish **FACE** flange and impeller seat and bore No. 3A Warner & Swasey
DRILL and **REAM** oil feed hole American Radial drill
Rough and finish **BORE** and **FACE** cylinder pads No. 3A Warner & Swasey
DRILL accessory drive side, (8) 25/64 holes and (11) 5/16 holes Baush multiple drill
DRILL thrust housing side holes Baush multiple drill
COUNTERBORE 11 holes on accessory side, and 21 holes on thrust bearing housing side, **COUNTERBORE** 29/64 holes and **BURR** Leland-Gifford single spindle drill
SPOTFACE (8) 25/64 holes to 15/16 diameter Leland-Gifford single spindle drill
DRILL 11/32 angular oil hole in pressure line American Radial drill
MILL oil sump pad Cincinnati horizontal mill
MILL breather pipe pad Cincinnati horizontal mill
DRILL 72 cylinder stud holes Cincinnati-Bickford drill
COUNTERBORE 72 cylinder stud holes 24 in. Cincinnati-Bickford drill
DRILL, COUNTERBORE, and **TAP** 4 holes in oil sump, **DRILL, COUNTERBORE,** and **TAP** 2 holes in breather pad, **DRILL** 1½ hole in breather pad. **DRILL** 1 cored hole, ¾ diameter in oil sump. **DRILL, COUNTERBORE, SPOTFACE,** and **TAP** (2) ½-13 lifting eye holes Cincinnati radial drill

OPERATION AND EQUIPMENT
COUNTERBORE 1 cored outlet hole in accessory housing side Leland-Gifford single spindle drill
BORE 9 intake pipe holes 24 in. Cincinnati single spindle drill
TAP 9 intake pipe holes 24 in. Cincinnati single spindle drill
DRILL vent holes Bench
DRILL No. 22 angular oil holes for front bearing plate American radial drill
DRILL ½ in. hole Leland-Gifford single spindle drill
BURR, CLEAN, and **POLISH** Bench
TAP thrust housing side (23) holes, **TAP** accessory housing side (11) holes Bakewell tapping machine
Machine **TAP** cylinder base stud holes Leland-Giffofrd tapping machine
WASH
Finish **HAND TAP** 63 holes Bench
FINISH BORE diameter finish face front end, counterbore diameter and burr. Finish bore bearing hole No. 3A Warner & Swasey
REFACE impeller seat and remove burrs No. 3A Warner & Swasey
COUNTERSINK holes front and rear face, **BURR** outside diameter of faces, **HAND POLISH** scratches
WASH
INSPECT
BENCH
DEGREASE
PAINT prime coat
PAINT three coats enamel

is employed for the second holding on the front spindle.

The Curtiss propeller hub marks another of the typical aircraft jobs in which a relatively large and heavy drop forging is progressively whittled down to a light, meticulously finished part, held to extremely fine limits as to size and surface finish. This part requires a total of 53 individual handlings which are shown in detail on the routing. One of the interesting features of the set-up is the Cincinnati Hydrotel milling machine used to form the contours between the barrels. Another outstanding piece of equipment is the huge horizontal Colonial broaching machine tooled for broaching the splines.

Commercial Engine Department

The operation of the commercial engine department exemplifies practices consistent with the requirements of national defense. In the first place, all of the activity has been concentrated in a relatively small area isolated from the radial engine departments. What is even more important at the moment is that Lycoming has found it feasible to utilize the old machinery on hand, thus making it possible to set up the production department without delay and without drawing upon new equipment so urgently needed for national defense.

Up to the present writing, Lycoming concentrated on the manufacture of its original line of small 4-cylinder engines. However, by the time this article is off the press, Lycoming will be in production on its new line of four- and six-cylinder engines mentioned earlier. The new engines have individual steel cylinder barrels with shrunk-on aluminum cylinder heads, following the same practice as is found on the radial engines. This is in striking contrast to the design of the small engine, which is made up of two major crankcase sections, each one with two cylinders cast integrally.

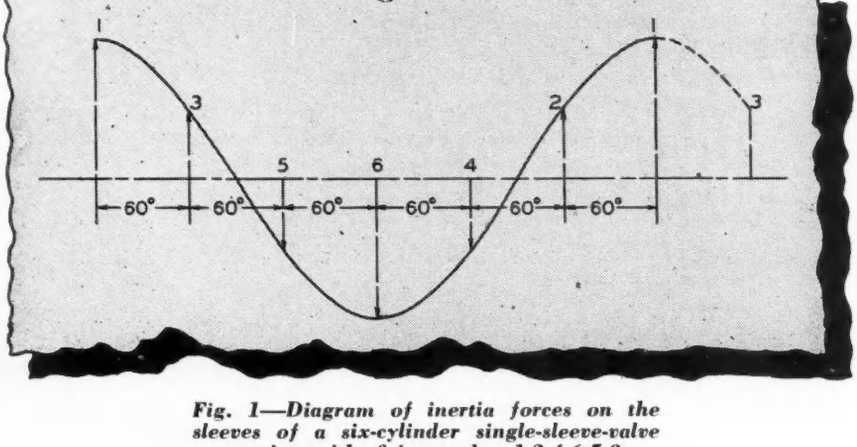
These differences in basic structural design cannot be overemphasized when it is considered that the major elements of both the current line and the new line have been tooled for machining over the same equipment. Although this in itself is an important accomplishment, it is still more impressive to find that the new tooling and fixtures designed for the existing machines have been so arranged as to accommodate similar operations for the entire line of commercial engines.

It will be recognized that this principle of interchangeability of work holding fixtures and tooling marks a major step in furthering an economical handling of multiple-lot production problems.

Much to our regret the new tooling was not ready for installation at the time the writer visited Williamsport. For this reason, we shall have to confine ourselves to the material available on the manufacture of the small four-cylinder engine. However, the routing of the cylinder-crankcase assembly is quite typical

(*Turn to page* 48, *please*)

Rocking Couples in 6-Cylinder



Sleeve motion always produces a rocking couple, but the latter is less than half as large with some firing orders as with others

Fig. 1—Diagram of inertia forces on the sleeves of a six-cylinder single-sleeve-valve engine with firing order 1-2-4-6-5-3

By P. M. HELDT

AT A recent gathering of automobile engineers the question was raised whether or not a rocking couple is produced by the reciprocating motions of the sleeves in a six-cylinder, single-sleeve-valve engine. The general impression has been that there is such a couple, but one man argued that the effect was similar to that produced by two three-throw 120-deg. crankshafts connected end to end. Each of these crankshafts with its crank train will produce a longitudinal rocking couple, but these two couples, he held, would cancel out.—Engines with single-sleeve valves have been used in automobiles and motorcycles in the past, and they are now being used for aircraft by one firm in England.

In an engine of the type under discussion, each sleeve is moved up and down directly by a small crank, and its up-and-down motion (or motion in the direction of the cylinder axis) therefore, can be correctly represented by a double sine curve (Fig. 1). The inertia forces due to the acceleration and deceleration of the sleeves also can be represented by such a curve. In order to prove that there is a rocking couple due to the motion of the sleeves, it is only necessary to show that at some arbitrary position of the valve shaft there is a couple on the engine block due to the forces on the sleeves, and that at some other position of the valve shaft (180 deg. from the former, for instance), there is a couple of opposite hand on the block.

Before the investigation of the subject is carried very far, it is discovered that the couple produced depends on the firing order used. There are eight possible firing orders for six-cylinder in-line engines, as follows:

Table 1 Six-Cylinder Firing Orders

(1)	1-3-2-6-4-5	(5)	1-2-4-6-5-3
(2)	1-3-5-6-4-2	(6)	1-2-3-6-5-4
(3)	1-4-2-6-3-5	(7)	1-5-4-6-2-3
(4)	1-4-5-6-3-2	(8)	1-5-3-6-2-4

The phase angle between sleeves in cylinders that succeed one another in the firing order is equal to 60 deg. It will be seen that with each of the eight firing orders cylinder No. 6 follows cylinder No. 1 at three intervals of 60 deg., hence the phase angle between sleeves 1 and 6 is always 180 deg. or half a cycle. In other words, when the sleeve in cylinder 1 is at the top of its stroke, that in cylinder 6 is always at the bottom of the stroke, no matter what firing order is used. Since the inertia force on the sleeve when at the top of the stroke is upward, and when at the bottom of the stroke, it is downward, it follows that these two sleeves by themselves produce a couple. The couple produced, moreover, is a rocking couple, for after half a turn of the valve shaft the force on sleeve 1 is downward and that on sleeve 6 upward, so that the couple is reversed.

Of course, in addition to sleeves 1 and 6 there are four others, which also are either accelerating or decelerating and, therefore, subjected to inertia forces; these forces react on the engine block at different distances from the center; they also create couples, and it is conceivable that these couples might neutralize that due to sleeves 1 and 6. These four sleeves differ in phase from sleeve 1 by 60 deg. and 120 deg., two of them leading sleeve 1 by these angles and two lagging behind it. At + 60 deg., + 120 deg., − 60 deg.

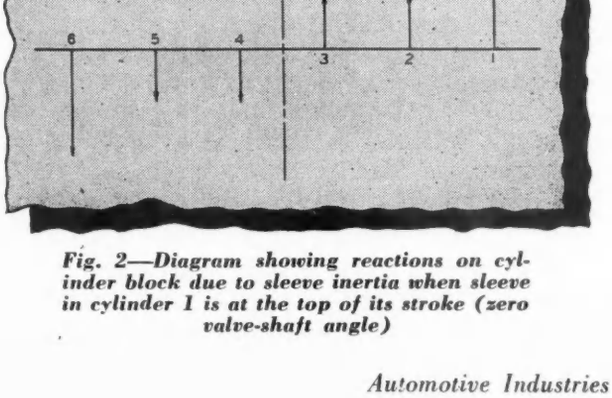


Fig. 2—Diagram showing reactions on cylinder block due to sleeve inertia when sleeve in cylinder 1 is at the top of its stroke (zero valve-shaft angle)

and − 120 deg. the inertia force on each sleeve is equal to one-half its maximum value. At + 60 deg. and − 60 deg. it is in the same direction as that due to sleeve 1 (which is at 0 deg.), and if sleeves 2 and 3 are in these two positions, as they will be with firing orders (2) and (5), then when the force on sleeve 1 is at its maximum in a given direction, the forces on sleeves 2 and 3 will be at one-half maximum in the same direction, and all three create couples of the same hand (see Fig. 2). Consequently, these firing orders give the maximum total couple.

If, on the other hand, cylinders 2 and 3, respectively, lead and follow cylinder 1 by 120 deg. in the firing order, as they do with firing orders (3) and (8), then when the force on sleeve 1 is upward and at its maximum, the forces on sleeves 2 and 3 will be downward and equal to one-half their maximum value (Fig. 3). In that case the moments due to sleeves 2 and 3 are of opposite hand to that due to sleeve 1. The forces due to sleeves 2 and 3 are each equal to one-half that due to sleeve 1, but the latter acts on a longer lever

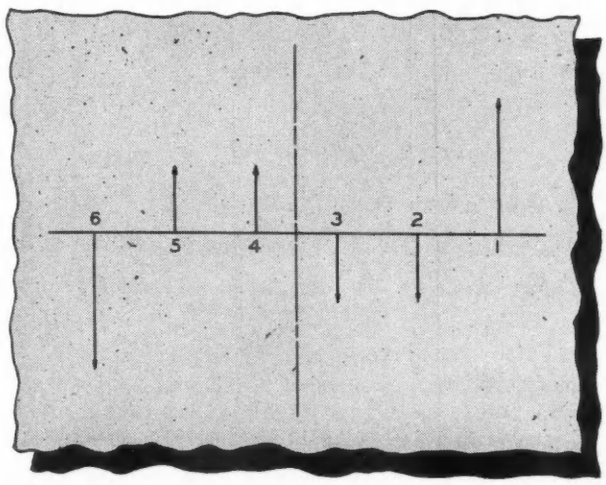


Fig. 3—Reactions on cylinder block at zero valve-shaft angle with firing order 1-4-2-6-3-5

arm than either of the former, and the moments due to sleeves 2 and 3, therefore, do not cancel out that due to sleeve 1.

The values of the couples depend, of course, on the lengths of the lever arms at which the forces act. These forces act at the centers of the various cylinders, and we will assume that all cylinders are equally spaced (which makes for simplicity and does not introduce any material error even if the two middle cylinders are spaced slightly farther apart, as is usually the case). Then, if we designate the cylinder spacing by a, the force due to sleeve 1 acts on a lever arm of length 2.5 a (measured from the center of the engine), that on sleeve 2, on a lever arm equal to 1.5 a, and that due to sleeve 3, on a lever arm equal to 0.5 a. The couple due to the forces on sleeves 1 and 6 then is equal to 5 a F, where F is the maximum force on any one sleeve; that due to forces on sleeves 2 and 5 is equal to 1.5 a F, and that due to forces on sleeves 3 and 4, to 0.5 a F. These latter two couples are in opposition to the couple due to sleeves 1 and 6, but as their sum is only 2 a F, they do not cancel that due to sleeves 1 and 6, which is equal to 5 a F, the remaining couple being 3 a F. This applies to engines with firing orders (3) and (8). With firing orders (2) and (5), when the couple due to sleeves 1 and 6 is at its maximum in one direction, couples due to the other four sleeves are in the same direction, and all couples add together, making the total equal to 7 a F.

With the remaining four firing orders, forces due to sleeves 2 and 3 are opposite in direction when that due to sleeve 1 is at its maximum, as is also the case with the forces due to sleeves 4 and 5, respectively. This means that while the couple due to one pair of these forces is of the same hand as that due to sleeves 1 and 6, that due to the other pair is of opposite hand, and the total couple, therefore, has a value intermediate between those found for firing orders (2) and (5) on the one hand and (3) and (8) on the other.

It has thus been shown that in a six-cylinder in-line single-sleeve-valve engine there is always a rocking couple due to the motion of the sleeves, and that for the point of the cycle for which the investigation was carried through (sleeve 1 at the top end of its stroke), the value of the couple varies widely with the firing order. This point of the sleeve-motion cycle was chosen arbitrarily, and we have no assurance that—with any given firing order—the couple is at its maximum value when the valve shaft is in this position. As a matter of fact, it is not with any of the possible firing orders. If it should be decided "to do something" to eliminate the couple thus created, it is necessary to determine its maximum value for the particular firing order chosen, and also the angle of the valve shaft at which it occurs. These calculations, of course, must be carried through separately for each firing order. We will carry it through first for firing order (5), which is the one now being used in practically all six-cylinder engines with poppet valves (for the reason that it minimizes trouble from torsional vibration).

When the sleeve in cylinder 1 is at the top of its stroke, the valve-shaft angle is considered to be zero. Now assume the valve shaft to make an angle θ with that position, in which case the couple due to the inertia forces on sleeves 1 and 6 is 5 a F cos θ. That due to inertia forces on sleeves 2 and 5 is 3 a F cos (θ − 60 deg.), and that due to the inertia forces on sleeves 3 and 4, a F cos (θ + 60 deg.). Consequently, the value of the total couple due to all six sleeves is

$$C = a F (5 \cos \theta + 3 \cos (\theta - 60 \text{ deg.})) + \cos (\theta + 60 \text{ deg.})$$

By now substituting for the expressions cos (θ − 60 deg.) and cos (θ + 60 deg.) their equivalents, we get

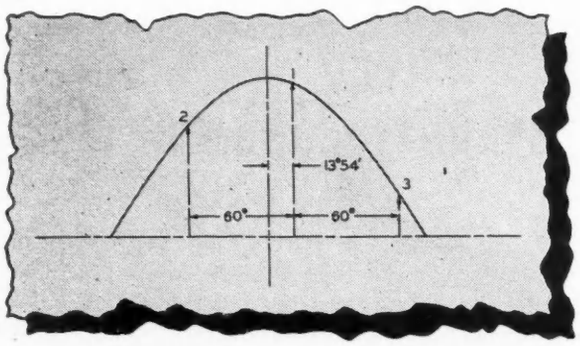


Fig. 4—Showing magnitudes of forces on sleeves 1, 2, and 3 when the rocking couple is at its maximum value with firing order 1-2-4-6-5-3

$$C = a F [5 \cos \theta + 3 (\cos \theta \cos 60 \text{ deg.} + \sin \theta \sin 60 \text{ deg.}) + \cos \theta \cos 60 \text{ deg.} - \sin \theta \sin 60 \text{ deg.}]$$

$$= a F (5 \cos \theta + 4 \cos \theta \cos 60 \text{ deg.} + 2 \sin \theta \sin 60 \text{ deg.})$$

and since cos 60 deg. = 0.5 and sin 60 deg., 0.866, this reduces to

$$C = a F (7 \cos \theta + 1.732 \sin \theta),$$

which is the expression for the instantaneous value of the rocking couple.

To find the angle θ at which the couple attains its maximum value, we differentiate the above expression and place the first differential coefficient equal to zero, which gives

$$a F (- 7 \sin \theta + 1.732 \cos \theta) = 0$$

$$7 \sin \theta = 1.732 \cos \theta$$

Squaring both sides

$$49 \sin^2 \theta = 3 \cos^2 \theta$$

$$16.33 \sin^2 \theta = \cos^2 \theta = 1 - \sin^2 \theta$$

$$17.33 \sin^2 \theta = 1$$

$$\sin^2 \theta = 0.0578$$

$$\sin^2 \theta = 0.2404 \text{ and } \theta = 13°54'$$

The couple, therefore, attains its maximum value when the valve shaft has passed the zero position by 13°54′, and it is then equal to

$$C_m = a F (7 \cos 13°54' + 1.732 \sin 13°54')$$

$$= a F (7 \times 0.9707 + 1.732 \times 0.2402) = 7.211 \, a F$$

This is slightly more than the value of the couple when θ is equal to zero, that is, when the sleeve in cylinder No. 1 is at the top of its stroke. Since cos 0° = 1 and sin 0° = 0, it will be readily seen that the expression for the instantaneous couple then gives the value 7 $a F$.

The phase relations of sleeves 1, 2 and 3 and the instantaneous values of the forces on them when the rocking couple is at its maximum are shown in Fig. 4, while in Fig. 5 these forces are shown acting on their respective lever arms. It may be pointed out in this connection that regardless of the firing order, sleeve 2 is always in phase opposition to sleeve 5 and sleeve 3 to sleeve 4.

The zero value of the couple is attained when the valve shaft has turned through an angle of 90 deg. from the position of the maximum value, that is, in this case when θ is equal to 13°54′ + 90° = 103°54′. The cosine of 103°54′ is − 0.2402 and the sine, 0.9707, and

$$7 \times (- 0.2402) + 1.732 \times 0.9707 = 0$$

Phase relations of sleeves 1, 2, and 3, and the instantaneous values of the forces acting on these sleeves when the rocking couple is equal to zero are shown in Fig. 6, while Fig. 7 shows these forces acting at the ends of their respective lever arms. By multiplying the lengths of the arrows representing these different forces by twice the lengths of their respective lever arms (5, 3 and 1) and adding the products, the result is found to be zero. It is, moreover, fairly obvious on mere inspection that the moments around the center point cancel out. It may be recalled here that all of these calculations are based on the assumption of equal spacings between all cylinders. With unequal spacings the values of the two constants in the equation for the instantaneous value of the couple would change slightly.

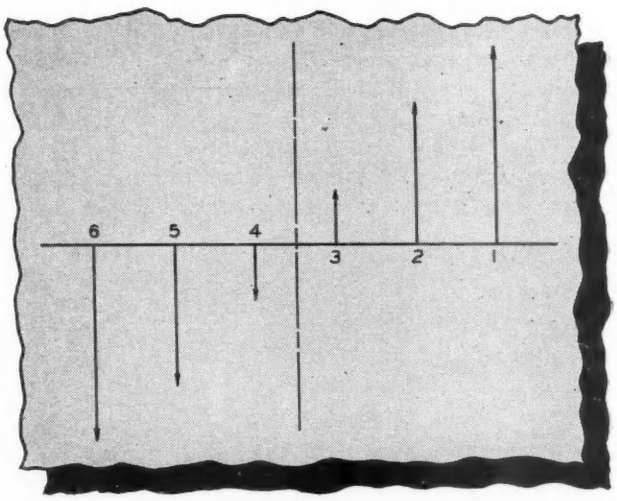


Fig. 5—Diagram of the couple when at its maximum value

The maximum values of the rocking couple and the valve-shaft angles at which they occur have been calculated for all eight firing orders and the results are given in Table II.

A certain six-cylinder single-sleeve-valve engine actually built had the firing order (8), which, as

Table II—Rocking Couples in a Six-Cylinder Single-Sleeve Engine

No.	Firing Order	Expression for Rocking Couple	Angle of Maximum Value of Rocking Couple	Maximum Value of Rocking Couple
		$aF \times$		
(1)	1-3-2-6-4-5	4 cos θ + 3.464 sin θ	40° 55′	5.29 aF
(2)	1-3-5-6-4-2	7 cos θ − 1.732 sin θ	−13° 54′	7.21 aF
(3)	1-4-2-6-3-5	3 cos θ + 1.732 sin θ	30°	3.46 aF
(4)	1-4-5-6-3-2	6 cos θ − 3.464 sin θ	−30°	6.93 aF
(5)	1-2-4-6-5-3	7 cos θ + 1.732 sin θ	13° 54′	7.21 aF
(6)	1-2-3-6-5-4	6 cos θ + 3.464 sin θ	−30°	6.93 aF
(7)	1-5-4-6-2-3	4 cos θ − 3.464 sin θ	−40° 55′	5.29 aF
(8)	1-5-3-6-2-4	3 cos θ − 1.732 sin θ	−30°	3.46 aF

will be seen from the table, gives the minimum rocking couple. The thought naturally occurs that this may not have been a mere coincidence, but that the effect of the firing order on the couple may have been investigated.

The results arrived at analytically can be readily checked by a simple graphical method. In Fig. 8 this method is applied to firing order (2). The vertical diameter of the circle is the datum line from which valve-shaft angles are measured. With this firing order the couple reaches its maximum value when the valve shaft is at − 13°54′, and we therefore draw a radius of the circle which makes an angle of − 13°54′ with the datum line, and five other radii, all six radii being separated by 60 deg. We next project these radii on the datum line. Assuming that the length of the radius represents the maximum value of the inertia force on one sleeve, the length of its projection on the datum line represents the momentary value

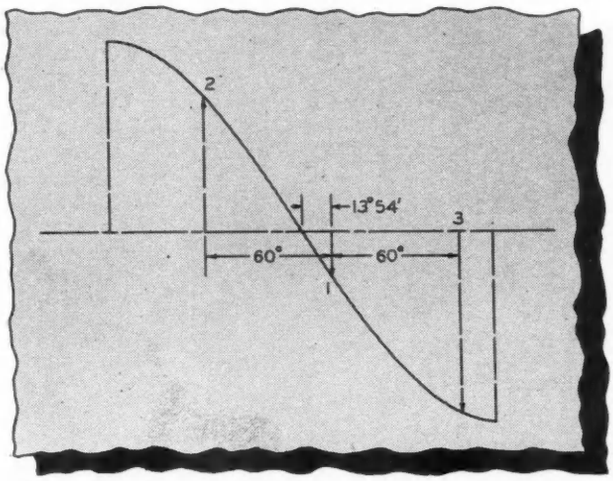


Fig. 6—Diagram showing values of inertia forces on sleeves 1, 2, and 3 when the couple passes through zero (firing order 1-2-4-6-5-3)

of the inertia force on the sleeve represented by the particular radius or vector, at the moment when the total rocking couple is at its maximum. It will be seen that all three projections are above the center of the circle, and their values therefore are all positive. By now multiplying the length of projection 1 by 5, the length of projection 2 by 3 and the length of projection 3 by 1, adding the three products and then dividing by the radius of the circle, we obtain 7.21, the coefficient of the expression for the maximum value of the rocking couple, which checks the result.

A further check is obtained by turning the datum line left handedly through 90 deg., bringing it into the position shown by the dotted line. This corresponds to turning the valve shaft 90 deg. right handedly or forward, thus bringing it into the position at which the rocking couple should pass through zero. If now we project vectors 1, 2 and 3 on the dotted datum line (as shown by dotted lines), we notice that the projections of 1 and 3 are to one side of the center while the projection of 2 is on the opposite side. As a matter of fact, the sleeves 1 and 3 are still accelerating downwardly, hence the reactions of the accelerating forces

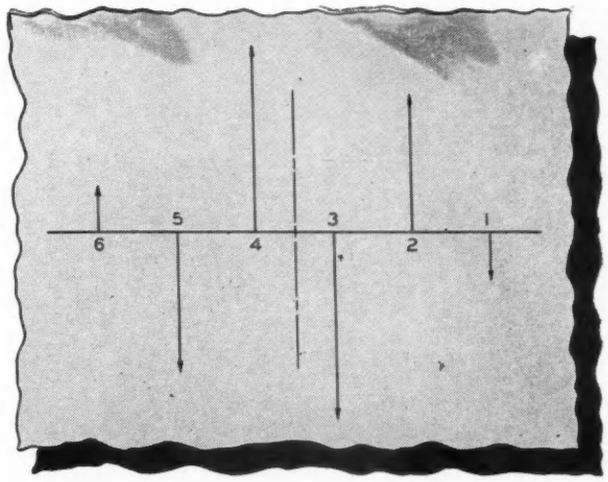


Fig. 7—Diagram of forces when rocking couple passes through zero

on them are upward or positive at this angular position of the valve shaft, while the force on sleeve 2 is downward or negative. By now multiplying the length of projection 1 by 5, that of 2 by 3 and that of 3 by 1, we find that the algebraic sum of all three products is zero and that the couple therefore passes through zero at this angular position of the valve shaft.

The rocking couple produced by the motion of the sleeves can be compensated for by providing the engine with an additional shaft located symmetrically to the valve shaft on the opposite side and turning at the same speed in the opposite direction, both shafts being provided with suitable eccentric weights at each end, the weights on opposite ends of each shaft extending in opposite directions therefrom. If the two shafts are so geared together that the eccentric weights at the same end are in the upward direction at the same time, then these eccentric weights will produce a rocking couple which is equal and opposite to that due to the sleeves, and will cancel it out.

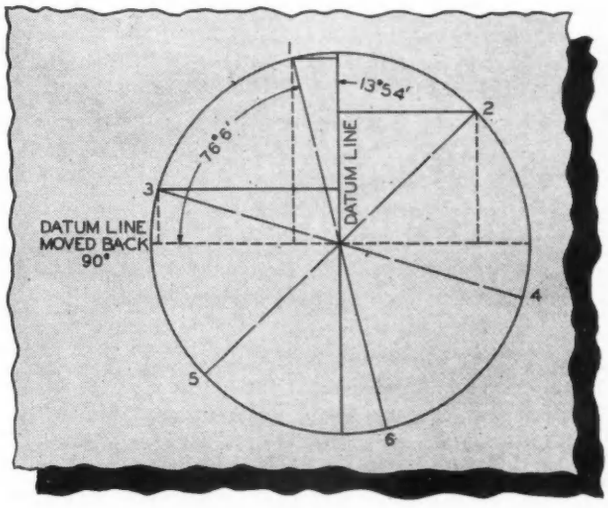
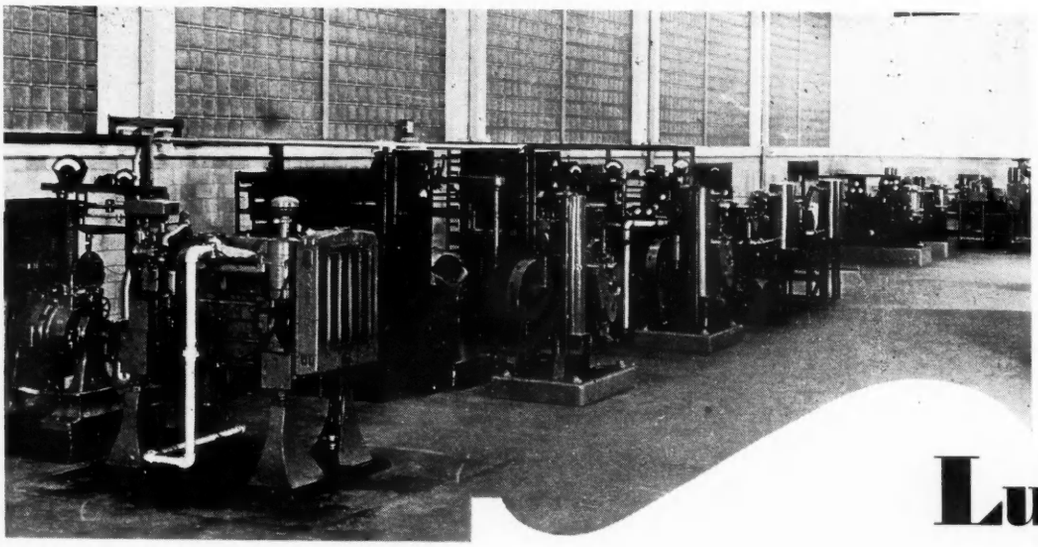
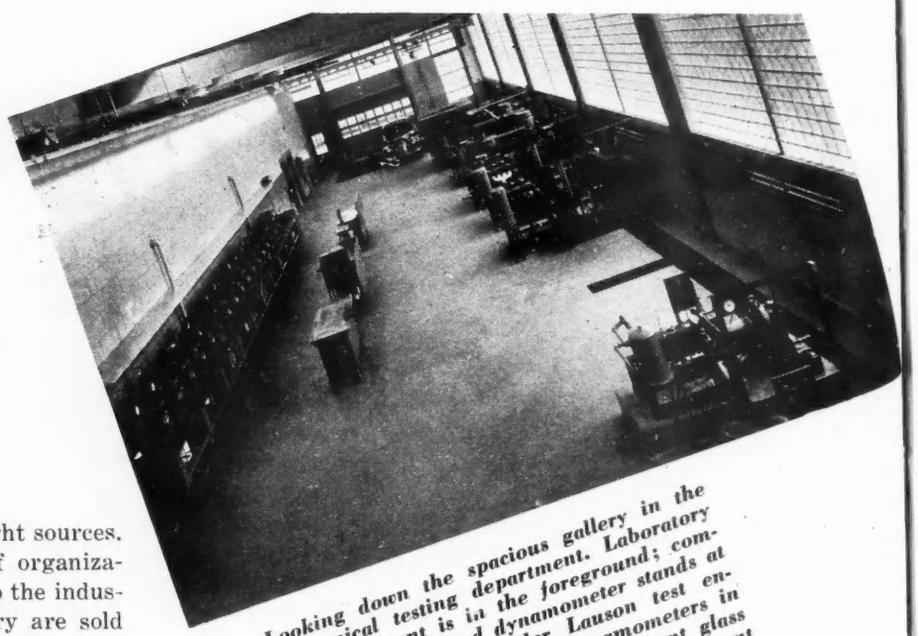


Fig. 8—Graphical check on the value of the maximum rocking couple and on the valve-shaft angle at which it occurs, for the firing order 1-3-5-6-4-2



Close-up of some of the dynamometer stands in the mechanical lab. Caterpillar tractor diesel engines and stationary diesels are in the foreground.

Lubri-Zol



Looking down the spacious gallery in the mechanical testing department. Laboratory test equipment is in the foreground; commercial engines and dynamometer stands at the right; single-cylinder Lauson test engines at the left; chassis dynamometers in the background. Note the translucent glass brick wall and partition; also the fluorescent lighting overhead.

TYPIFYING the sweep of technology in the automotive industry, with its background of fundamental research, is the new laboratory plant commissioned early this year by the Lubri-Zol Corp., Cleveland, Ohio. Situated on the outskirts of the east end of Cleveland, away from the tempo of industrial activity, the new laboratory is housed in a modern brick building, 90 x 140 ft., high ceilinged and with walls of translucent Insulux glass brick. The interior is spacious, designed specifically for its purpose, provides excellent seeing facilities through the installation of well-spaced fluorescent light sources.

Lubri-Zol is one of the great number of organizations whose product is primarily a service to the industry. None of the products of its laboratory are sold directly to the user, except for securing field data, nor are they identified uniquely since they are intimately compounded in nationally distributed petroleum products. Principal contribution of the Lubri-Zol organization is a line of additives compounded with petroleum products for the following uses:

1. For gear oils, including hypoid gear lubricants.
2. For motor oils and aviation lubricants—for gasoline and Diesel engines—to improve detergency, to inhibit corrosion, to improve oxidation resistance, etc.
3. For gasolines to inhibit gumming, to secure top cylinder lubrication, to reduce carbon deposits.
4. For cutting-fluid concentrates of various types.

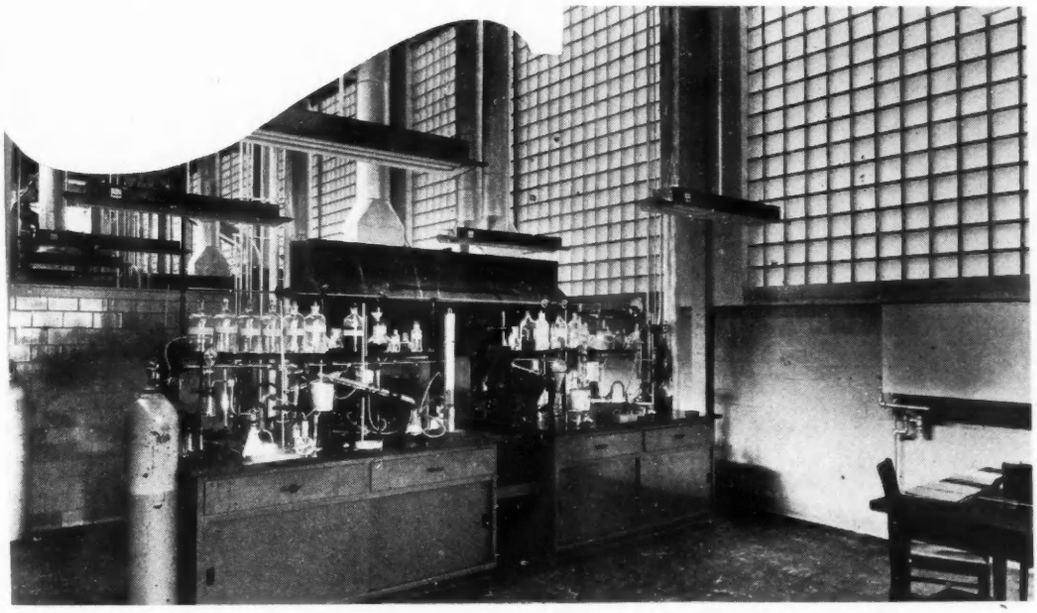
Laboratory activity is divided into two major classifications—(a) fundamental research in chemistry, aimed at the development of new additive products and the improvement of existing materials; and (b) mechanical testing with single-cylinder test engines and full sized commercial engines for studying the problems of internal combustion engine lubrication, to obtain information leading to a proper selection of additives for oils for different types of service.

In the process the laboratory personnel is in intimate touch with engine builders and vehicle manufacturers, providing a background of intelligent cooperation on problems pertaining to the utilization of fuels and lubricants, and providing scientific facilities for the study of new or troublesome service conditions. This is coordinated with a corps of field engineers whose job it is to keep abreast of lubrication requirements and developments, as well as to collect evidence in the field showing the effectiveness of Lubri-Zol processed lubricants.

In operation, the chemical research laboratory investigates the properties of different types of oils, the characteristics of addition agents, and their effects

upon unique oil properties. The mechanical department carries out programs of experimental operation of laboratory and commercial engines, simulating service conditions. It is charged with the job of investigating the innumerable combinations of oils and addition agents to determine their suitability under field conditions. Finally, the analytical and control laboratory supervises the manufacture of products, checks the quality of raw materials and maintains quality levels.

Has New Research and Testing Laboratory



A view of one of the chemical laboratories, accenting high ceilings, excellent equipment, and exceptional lighting.

The building proper is divided into three principal galleries. The largest of these, the engine laboratory, is illustrated here. In the foreground, at the right and out of view of the camera, is the group of "film-strength" testing machines; at the right, along the outer wall, are the dynamometer stands with commercial engines of various makes; at the left, along the dividing wall, is the battery of 20 single-cylinder Lauson engines. In the extreme background may be seen the chassis dynamometers for testing full-scale engine and axle operation in passenger cars and trucks.

The chemical laboratory occupies the gallery along the opposite wall, and includes self-contained lab rooms for the following activities — analytical lab, routine chemical testing, organic preparations (two rooms), oxidation and corrosion testing, bomb room for high pressure experimental work. The center gallery, along the dividing wall, comprises the lab office, a large blending room, and drum storage in the rear. The latter contains drum samples of all manner of lubricants supplied by various refiners.

The chemical laboratory personnel consists of 10 graduate chemists and seven high school graduates proficient in laboratory work. On the basis of past experience, an average organic preparation has required approximately 13 hr., while an average routine test takes about 53 min. Over a period of six years, the chemical lab has prepared some 5000 samples for testing, including the parallel preparation of 3500 organic samples. Altogether during this period, the mechanical laboratory has received materials for about 50,000 routine tests.

Perhaps of greatest interest to the engineers and chemists in automotive plants is the equipment found in the mechanical laboratory. A full inventory of this equipment is given below:

2—1936 Chevrolet engines
1—1936 Ford V-8 engine
1—1936 Chrysler engine
2—1939 Chevrolet engines
2—1941 Chevrolet engines
2—471 GM diesel engines
2—Caterpillar single cylinder test engines
1—Caterpillar D-4400 test engine
20—Liquid-cooled single cylinder engines

(*Turn to page* 48, *please*)

MEN and

PROBABLY the most paradoxical engineering practices in years will be used in 1942 automobile engines to accomplish the same purpose—long bearing life. It is accepted generally that lubrication of a highly polished steel surface results in a continuous, unbroken film of oil, and thus prevents metal-to-metal contact. The surface depressions are held 4 to 5 micro-inches in depth and in some instances to 1.5 micro-inches.

Now, after extensive testing, one large producer concludes that with a "rough" finish of 40 to 70 micro-inches bearing wear and failures are substantially less. The theory is that lubrication is improved and that, consequently, bearing temperatures are lower. This new specification, it is understood, has been adopted for the crankshaft bearings, both mains and crankpins, and possibly will be extended to other steel bearing surfaces.

BELIEVED to be the largest of their kind ever manufactured, tantalum-tungsten carbide dies for the cold nosing of 105 mm. shells have been produced by Vascoloy-Ramet Corp., North Chicago, Ill. The work is done on conventional vertical mechanical presses, the shell being held in a fixture on the bed of the press while the die descends and performs the nosing operation. A production rate of 120 shells per hr. per press is reported.

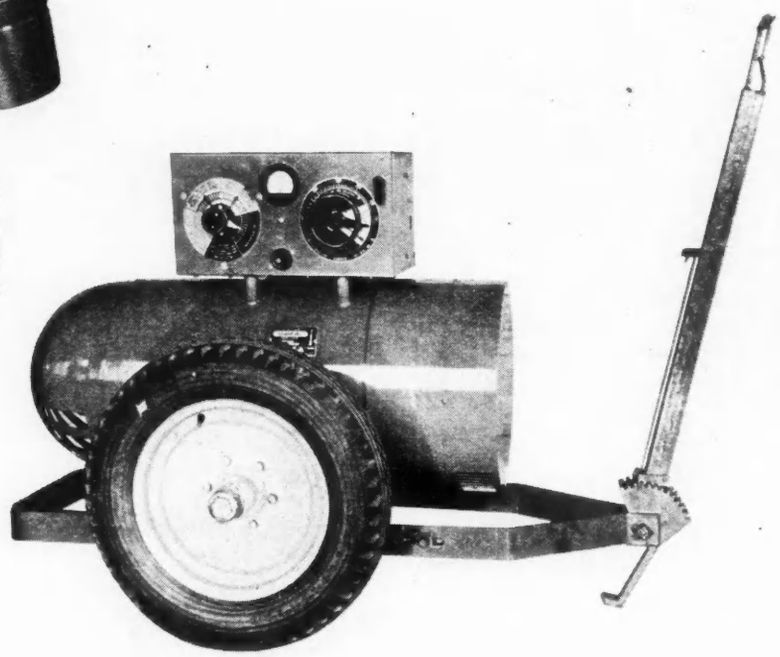
Cold nosing of shells ordinarily involves a problem of scoring, galling and "pick-up," which often results in a high rejection percentage and considerable die wear. The tantalum carbide content is said to overcome this problem by imparting a peculiar lubricating characteristic.

The die consists of a tantalum-tungsten carbide insert, the inside of which is finished to the contour of the shell, firmly mounted in a substantial steel casing. It is estimated that each die will nose several million shells.

A NEW two-wheeled light-weight pneumatic-tired trailer for mounting arc welding machines for easy, fast portability has been placed on the market by Lincoln Electric Co., Cleveland. Designed for mounting either Lincoln S.A.E. 200 to 600 ampere AC motor driven, or Type SA 200 special engine driven Lincoln arc welders, the new unit can be used for road towing up to approximately 30 m.p.h. or can be moved easily by hand.

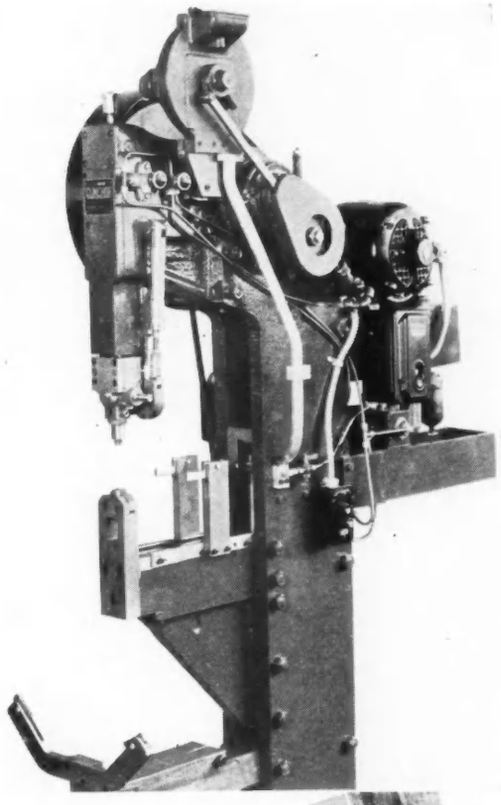
The unit measures 66 in. long, 42 in. wide, 16 in. high (over tires) and weighs 282 lb. Tires are 5.50-16-4 ply.

(Above) Vascoloy-Ramet tantalum-tungsten carbide dies for cold nosing operation on 105 mm. artillery shells



(Right) Lincoln trailer for hauling arc welding machines. Mounted on it is a motor driven arc welder.

MACHINES

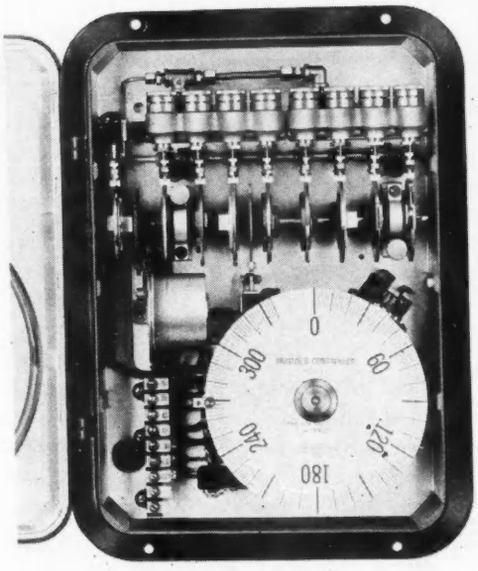


PIERCING work for riveting, inserting the rivet and setting it is accomplished in two successive strokes in the RK Rivet-Pierce Rivitor of the Tompkins-Johnson Co., Jackson, Mich. A rivet is fed from the track from the hopper at every other stroke of the ram, being left in the fingers at the anvil. A spot light indicates on the work the location of the rivet underneath. The ram descends and forces the work down over the unannealed rivet, punching a slug out of the work. The slug escapes through a hole in the front of the head, which latter reverses (90 deg.) on the upstroke, to bring the riveting head in position. The ram descends and heads the rivet. On the upstroke, the head reverses again to bring the piercing die into position for the next stroke.

FOR use with timing facilities in spot welders, the Westinghouse Electric & Mfg. Co. now is making an electronic welding contactor known as SW 150 Weld-O-Trol, which is rated equivalent to a size 2-W mechanical contactor at 220 or 440 volts, 50-60 cycles. It is readily adaptable with heat control and either synchronous or non-synchronous weld timers including sequencing equipment. Welding is handled at extremely high rate of interruption by two heavy-duty water cooled ignitron tubes. All auxiliary control is mounted inside the Weld-O-Trol steel cabinet.

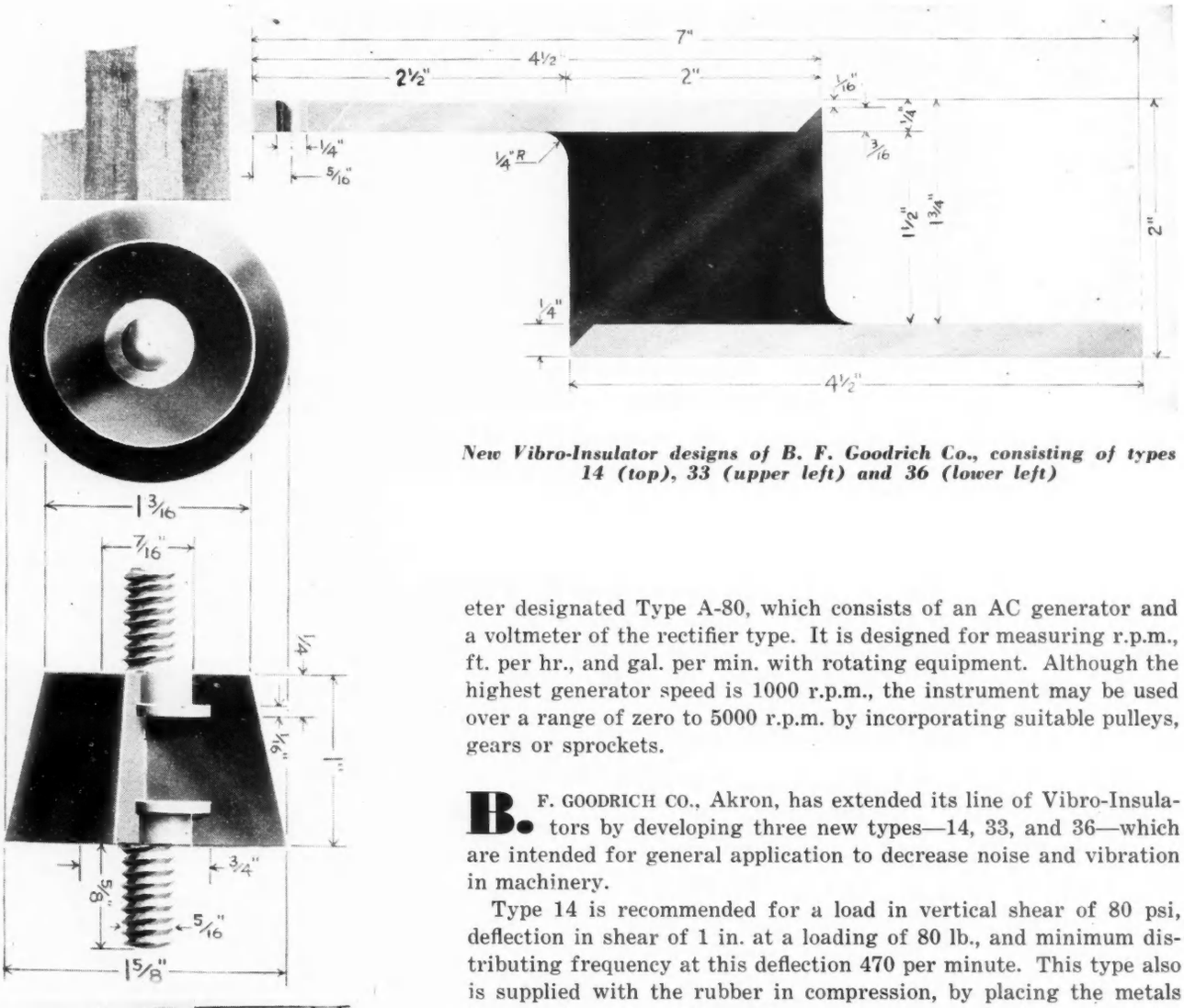
(Upper right) Tomkins-Johnson RK Rivet-Pierce Rivitor with automatic feed

(Below) Bristol Model A-118 Impulse-Sequence Cycle Controller



Westinghouse electronic contactor SW 150 Weld-O-Trol

Another new Westinghouse product is an AC current tachom-



New Vibro-Insulator designs of B. F. Goodrich Co., consisting of types 14 (top), 33 (upper left) and 36 (lower left)

eter designated Type A-80, which consists of an AC generator and a voltmeter of the rectifier type. It is designed for measuring r.p.m., ft. per hr., and gal. per min. with rotating equipment. Although the highest generator speed is 1000 r.p.m., the instrument may be used over a range of zero to 5000 r.p.m. by incorporating suitable pulleys, gears or sprockets.

B. F. GOODRICH CO., Akron, has extended its line of Vibro-Insulators by developing three new types—14, 33, and 36—which are intended for general application to decrease noise and vibration in machinery.

Type 14 is recommended for a load in vertical shear of 80 psi, deflection in shear of 1 in. at a loading of 80 lb., and minimum distributing frequency at this deflection 470 per minute. This type also is supplied with the rubber in compression, by placing the metals in a horizontal position. The maximum recommended load under compression is 250 psi, deflection at that loading of 5/16-in. and the minimum disturbing frequency at that deflection 850 per min.

In type 33 the rubber is applied only in compression, with the maximum loading 150 lb., and deflection at that point 5/32-in., with the minimum disturbing frequency at that deflection 1200 per min.

Type 36 is best for work with the rubber in compression, although it can also be applied in shear. With 35 and 50 durometer hardness, loading beyond 20 per cent of the rubber thickness, or 0.175-in. is not recommended. Under this load the minimum disturbing frequency is 1250 per min. and the load necessary to deflect 35 durometer mounting is 100 lb. and for 50 durometer mounting 85 lb.

TIMING mechanical operations in industrial processes is the purpose of a new multiple-cam time cycle controller that is being offered by the Bristol Co., Waterbury, Conn. It is called the Model A-118 Impulse-Sequence Cycle Controller (illustrated on page 33), which actuates or engages, at exactly the correct time in each cycle, the necessary mechanical, electrical, or pneumatic devices for automatically carrying out the intended schedule.

In this controller time measurement and pilot valve operation are handled by separate mechanisms. Timing is accomplished by a Telechron-driven aluminum disk on which is printed a 25-in. time scale. The desired schedule of operations in incorporated into the controller by punching holes with an ordinary ticket punch on the time scale.

(*Turn to page 54, please*)

PRODUCTION LINES

Ferrous Pistons

One of the brightest bits of news we have found in recent months concerns the experience of an outstanding passenger car builder with cast iron pistons. This producer intends to start the model year with aluminum alloy pistons for the entire line, but has in reserve the necessary tooling for making ferrous pistons. When it was decided to get some experience with cast iron pistons, orders were issued to subject the test cars to the most unusual punishment. This brought out some early weaknesses in design, resulted in a piston construction which withstands the most severe tests without failure. Equally important is the fact that the use of ferrous pistons has left the engine unaffected in performance, top speed, and power output. In fact, they have found it possible to boost engine speed, if need be, and have increased compression ratio. The only mechanical change in the engine is the adoption of thin high-lead babbitt bearings for the mains and rods. This does not mean to imply that the manufacturer will switch from aluminum unless he has to, but it does prove that ferrous pistons will do a good job. It's a story of great interest not only for engineers but for the car owner as well.

Alternate Materials for Axles and Gears

While on the subject of alternate materials, it is of interest to record the accomplishments of many parts makers in the adoption of materials which do an excellent job of replacing alloy steels required for the national defense. One pertinent example is that of the Timken axle company, which recently developed an entirely new axle steel called Axaloy. Several varieties of this material are used for gears as well. Axaloy is said to have great strength, hardness, and uniformity. Another example is that of Eaton. This organization, too, has switched to alternate materials for axles and gearing for civilian production, without any sacrifice in strength or service life.

Special Materials

Examples of the use of unique engineering materials in automotive parts are to be found at every turn, although these days find their persistance chiefly in products made for the national defense. McCulloch superchargers, now being produced for naval diesel engines, use aluminum alloy housings, Ni-Resist end plates, the latter having about the same coefficient of expansion as aluminum. Another neat trick is the use of Ampco (aluminum-bronze) forged gears in combination with steel gears for driving the Roots blower rotors. Since Ampco metal expands at about the same rate as aluminum, the gear train back-lash remains practically constant regardless of operating conditions. Another case is that of the Warner Electric Brake Co., which is using Gunite castings for brake drums; Nichrome flat wire for winding the resistors for the brake control element. Here again the product is going primarily into national defense.

Ampco Line

Under the impetus of the national defense program, Ampco Metal, Inc., well-known producers of high grade industrial bronzes, serve the aircraft industry as sub-contractors, supplying sand castings, centrifugally cast parts, forgings, and machined bearings and other parts. This accelerated activity has been made possible by an ambitious expansion of facilities still under way. In addition to the aluminum-bronze bearings and other bronzes, Ampco produces a coated aluminum-bronze electrode material, and a wide assortment of non-sparking safety tools for all manner of operations carried on in a hazardous atmosphere.

Welding

Speaking from notes and lantern slides, at the S.A.E. Summer Meeting, Everett Chapman, pres., Lukenweld div., Lukens Steel Co., discussed the fundamentals of heavy duty welding procedure as applied to the fabrication of steel crankcases. He placed the emphasis upon correct design for welding as well as on the right welding procedure. His slides were concerned chiefly with photoelastic studies of poor welds as contrasted with good welds. Perhaps the most impressive part of the presentation was an action film taken while the specimens were being loaded and unloaded in the photoelastic machine. This is the first time we have seen motion picture technique applied to photoelastic studies and the audience was greatly impressed with the demonstration. Mr. Chapman told us that copies of the film are available for distribution and that he would be glad to make them available for technical group meetings, upon request. You can ask us of you wish.

Cutting Fluid

The Independent Research Committee on Cutting Fluids has revealed that it has developed a special reference cutting fluid for use in metal cutting tests. Interested laboratories can obtain samples of this material by application to Joseph Geschelin, committee chairman. The use of this reference material in actual machine tests is expected to provide a wealth of information concerning the cutting fluids requirements for metal cutting operations of every kind.

Statistical Theory and Dimensional Effect

For those who are building up references on the use of the statistical theory in engineering, we suggest the paper "Statistical Theory of the Effect of Dimensions and of the Method of Loading upon the Modulus of Rupture of Beams," presented by John Tucker, Jr., at the A.S.T.M. meeting in Chicago. This analysis of concrete structures indicates the inherent difference in the strength of duplicate test specimens no matter how carefully the specimens are made or tested. As an example, the paper demonstrates that the modulus of rupture of a beam will be decreased with beam length and with beam depth and will be greater in centrally loaded beams than in similar beams loaded at three points. Although the case study is made on concrete, the method should be of interest to research men working with all manner of materials.

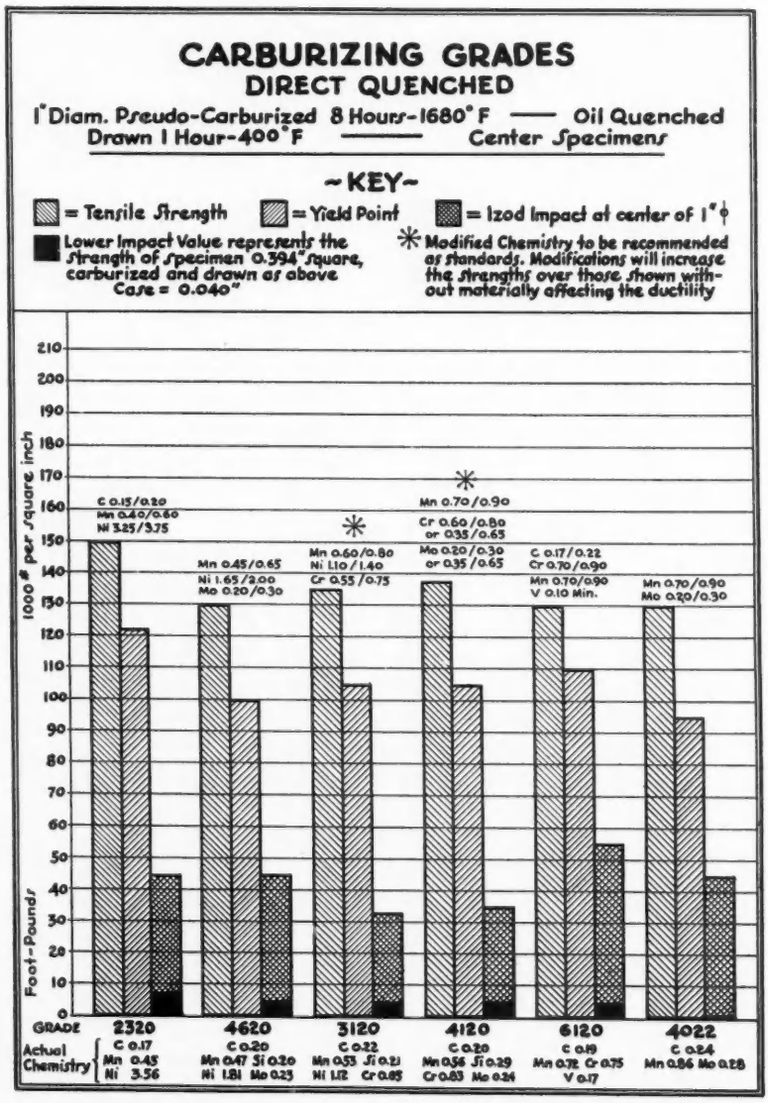
Salvage

T. E. Wickenden, The International Nickel Co., recently pointed out that there is a huge stock pile of scrap containing nickel which could be made available if the material could be readily identified. He recommended that in the future, nickel bearing scrap should be carefully segregated so as to be ready for immediate salvage. Another important suggestion was that there is considerable unnecessary use of nickel —as for example the fabrication of thousands of cafeteria trays of 18-8 stainless steel for military camps. Mr. Wickenden also noted an impending shortage of chromium. Out of the discussion of the subject at White Sulphur Springs came a plea to the OPM to find some certain method for assuring the comparatively minute tonnage of nickel required for exhaust valves, for thermostatic metals, and in the few places where heat-resisting properties are imperative and where no other metal could adequately serve as a substitute—on passenger cars, on trucks, and other automotive equipment. J. G.

Possible Substitutes

WHILE automotive manufacturers will be adversely affected by scarcities in nearly all of the so-called strategic materials, most trouble probably will arise from the scarcity of nickel. This metal is an important component of a large number of alloy steels used for highly stressed parts, including nickel, chrome-nickel, nickel-molybdenum and chrome-nickel-molybdenum steels. It is used also for plating, and it enters in large proportion into the alloy steels that are subjected to high temperatures in service, such as steels for exhaust valves. As the amount of nickel available for non-military uses will be definitely limited, it will become necessary to reduce the consumption of this metal in all of its applications, and suitable substitutes for nickel-alloyed steels will be in demand. The American Iron and Steel Institute, therefore, has rendered a definite service to the automotive and the mechanical industries generally by compiling and publishing a pamphlet on "Possible Substitutes for Nickel Steels." *

When some other material has to be substituted for one which has long been used for a given purpose but which is on longer available in sufficient quantity, a material is usually looked for which as nearly as possible has the same physical properties as the one to be replaced. The choice of steels for structural parts is seldom based on tensile strength alone; size of section is of prime importance among the factors that must be considered, and in some cases where large sections are involved it may be difficult to duplicate the effect of nickel and it may become necessary to redesign the part. Substitutions, moreover, may involve changes in fabricating methods, heat-treatment procedures, and facilities for its control.



Substitutions suggested in the pamphlet of the Iron and Steel Institute were chosen on the basis of data published by steel manufacturers, Climax Molybdenum Company, the International Nickel Company, and the Vanadium Corporation of America.

Nickel-bearing steels naturally divide into carburizing and thorough-hardening grades. The carburizing grades fall in the 2300, 2500, 3100, 3300, 4300, 4600 and 4800 classifications. Carburizing steels may be either quenched directly from the carburizing temperature; they may be pot-cooled from the carburizing temperature, then reheated and quenched in oil; they may be quenched directly from the pot and then tempered, and they may be pot-cooled and then subjected to two reheats and two quenchings in succession, though this latter treatment is rare.

The 2500 series of nickel case-hardening steels are used for aircraft engine crankshafts, and truck, bus and tractor transmission and differential gears. It is not suggested that other steels should be substituted for aircraft applications, but the 3300, *4300, 4300 and 4800 series have been used with success for non-military transmissions. The 4320, for instance, is being used for truck and bus gears. This contains an average of about 1.80, instead of 5.00 per cent nickel.

The principal use of the 3300 series in the aircraft and automotive fields is in aircraft-engine piston pins and gears, and in heavy-duty truck gears and bear-

* Contributions to the Metallurgy of Steel—No. 1: Possible Substitutes for Nickel Steels. The American Iron and Steel Institute, 350 Fifth Ave., New York.

for Nickel Steels

ings. The properties of this series are difficult to duplicate, and only the 4300 and *4300 can be suggested. The *4300, which has a higher molybdenum content than the 4300, will, if the carbon range is restricted, approach closely to the physical properties of the 3300 series, and extensive research is now being done on it.

The 4800 series, which contains an average of 3½ per cent nickel, has been used principally in transmission and differential gears and shafts for trucks, buses, and tractors. Series 4300 (1.65-2.00 per cent nickel) is suggested as a suitable substitute.

Series 2300 steels (3½ per cent nickel) are used chiefly for automotive gears, knuckle pins, shafts and collars. They may be replaced in all applications by the 4600 series (1.65-2.00 per cent nickel) and in most by the 4000, 3100, and 4100 series (with a much lower nickel content or none at all), depending on the size of the part and the service for which it is required. For some applications the 6100 series (no nickel) could be used.

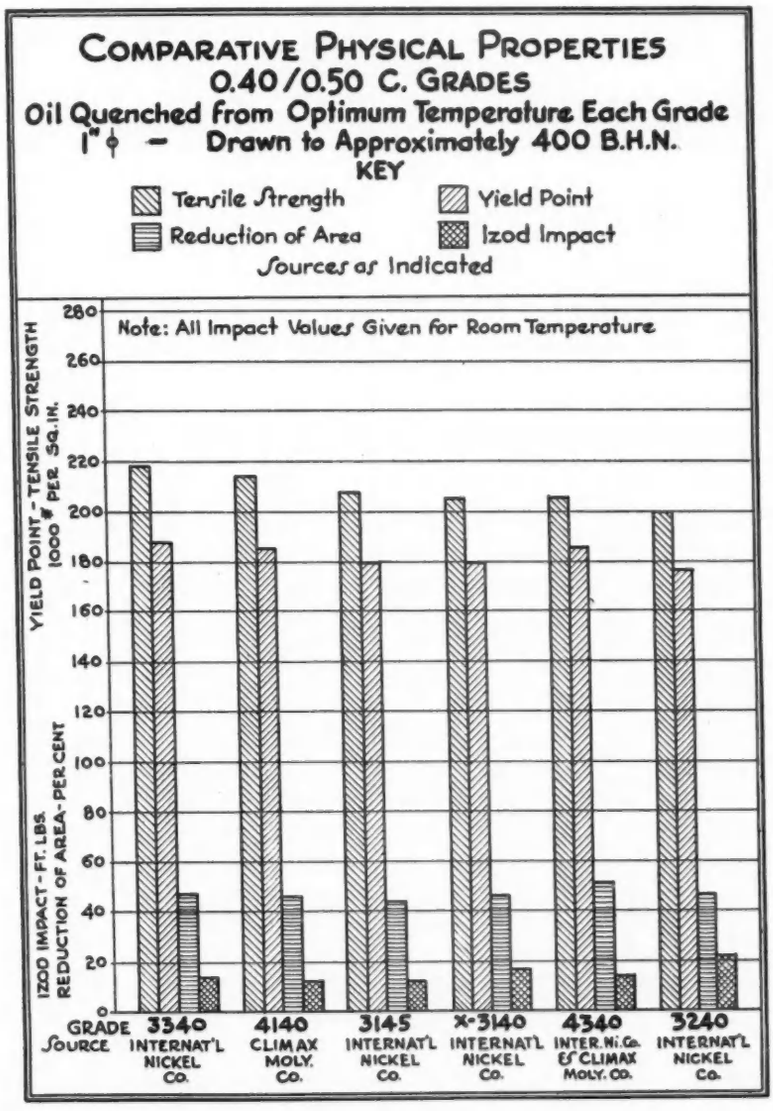
There is as yet no satisfactory substitute for the 4300 series of nickel-chromium-molybdenum steels, which have been used for bus and truck transmission and differential gears. It is the general belief that the properties of these steels can be duplicated only by resorting to very unusual chemical combinations, and the subject is now being investigated experimentally.

Principal uses of the 4600 series of nickel-molybdenum steels are in automobile and tractor transmission and differential gears, and in anti-friction bearing parts. It is also used in large quantities in the aircraft industry for gears and pins. No substitute for this steel for use in aircraft construction is recommended. In other applications steels of the 3100, 4000, 4100 and 6100 series can be used in the majority of cases, depending on the size of the part and the service required of it.

The 3100 series (1.10-1.40 per cent nickel) is used principally in tractor transmission gears and in anti-friction bearings. For most uses the 4100 and 6100 series (no nickel) can be substituted, and in many cases the 4000 and 5100 series (no nickel) will be found acceptable. The choice should be determined by the size of the part and the service required of it.

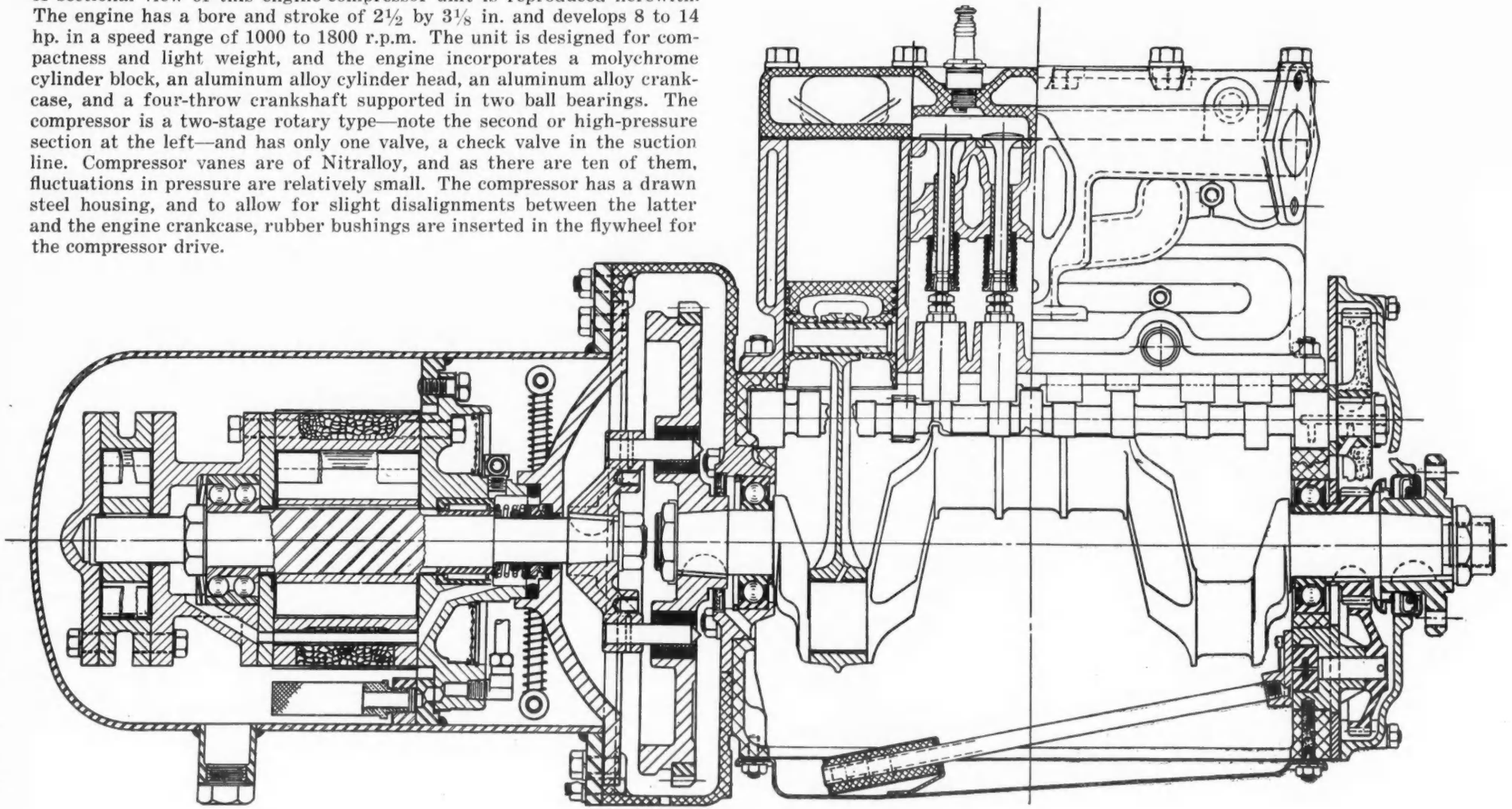
In the pamphlet of the American Iron and Steel Institute are given bar-type physical property charts, one chart for each of the steels it is desired to replace together with the steels which are suggested as suitable substitutes. The properties represented are the tensile strength, yield point, Izod impact value and lower impact value. These charts are very handy in that they make possible a direct visual comparison of the various alternates with the metal to be replaced, with respect to four of the significant properties. In the chart for steel No. 2320 and its alternates, for instance, it is seen that all of the alternates have a somewhat lower tensile strength and yield point than the metal to be replaced, while two of the alternates have at least equal ductility. In connection with two of the proposed alternates it is mentioned that modifications in the composition are being proposed which would increase the strength without

(*Turn to page* 50, *please*)

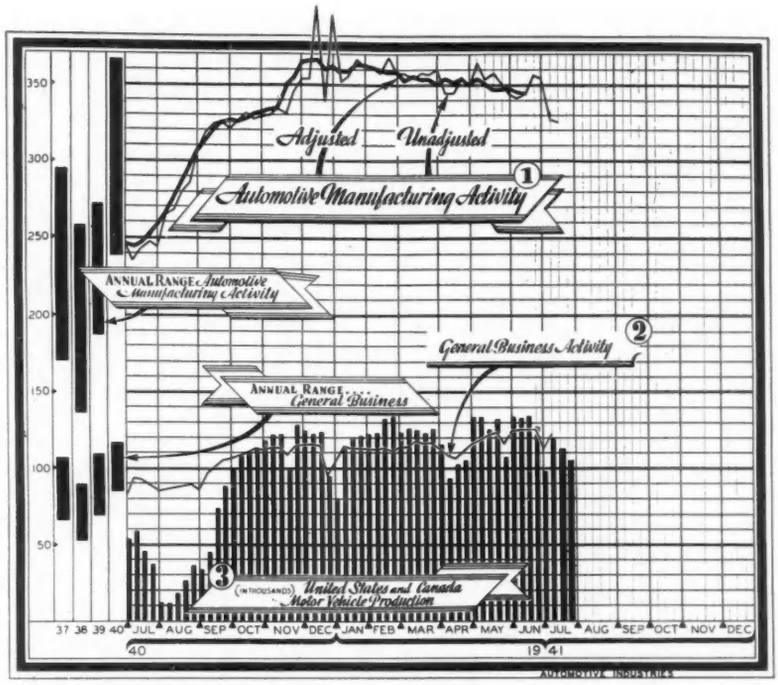


WAUKESHA ICE ENGINE

THE refrigerating system developed by Waukesha Motor Co. for motor trucks used in the transportation of perishable freight, comprises a four-cylinder gasoline engine with direct-connected rotary compressor. A sectional view of this engine-compressor unit is reproduced herewith. The engine has a bore and stroke of 2½ by 3⅛ in. and develops 8 to 14 hp. in a speed range of 1000 to 1800 r.p.m. The unit is designed for compactness and light weight, and the engine incorporates a molychrome cylinder block, an aluminum alloy cylinder head, an aluminum alloy crankcase, and a four-throw crankshaft supported in two ball bearings. The compressor is a two-stage rotary type—note the second or high-pressure section at the left—and has only one valve, a check valve in the suction line. Compressor vanes are of Nitralloy, and as there are ten of them, fluctuations in pressure are relatively small. The compressor has a drawn steel housing, and to allow for slight disalignments between the latter and the engine crankcase, rubber bushings are inserted in the flywheel for the compressor drive.



[*Our own view of automotive production and sales; authoritative interpretation of general conditions*]



Weekly Indexes of Automotive General Business

Detroit Expects Sliding-Scale Cut

THE CONCLUSION reached in Detroit regarding the current battle between various Washington factions is that output for the 1942 model year will undoubtedly total somewhere around half of the 5,250,000 vehicles produced in the U. S. during the 1941 model year, but that a sliding scale of reduction will be developed. A sliding scale is felt in automotive circles to be logical. Authorities point out, as an example, that a 50 per cent cut in the months immediately ahead would not expedite the production of arms in any degree whatsoever. Further, somewhere between 150,000 and 200,000 automobile and supply plant workers would perforce be laid off until next spring or later. Finally, no need is seen for near-term action. Industry sources say, by way of proof, that it will be spring before Chrysler's tank plant will need its maximum complement of 15,000 men or its maximum shipments of materials as well, even though operations will be under way in fairly substantial degree long before then. Similarly, Ford's bomber plant is not expected to require its full force of 60,000 until next summer.

The long-term hardships of output curtailment on the smaller plants are being keenly realized. It is pointed out that drastic reductions in the volume of the smaller companies may so reduce their dealer outlets that it would be intensely difficult for them, if not impossible, to resume their competitive position when normalcy ultimately returns. The widespread realization of this condition makes it appear that forthcoming cuts—some of which may be arranged by Aug. 1—are likely to be prorated like the original 20 per cent reduction, with the larger producers bearing a heavier proportion.

In the face of the uncertainty ahead, the industry worked through July at feverish pace, considering that it marked the model year's conclusion. The month will have seen produced, it is now estimated, close to 460,000 units. The week ended July 26 brought approximately 105,000 of these. General Motors share continued heavy, with about 52,000 assemblies, and Ford also was active with 26,000. The Chrysler divisions, moving toward changeovers, produced about 15,500. Of the independent passenger car makers, Studebaker, Packard and Willys were still operating on 1941 jobs in the week.

The final week of July was to see wholesale reduction from previous levels, with virtually all plants in the industry winding up 1941 model runs. The sag which could be expected to follow in the first week of August will be cushioned in part by resumptions in at least three plants, with more to follow quickly.

Sales continued to parallel the recent high rates of production but are now being held down by the dwindling supply of cars. June registrations appear to have fallen off more than seasonally from the record-high volume of May, due mainly to the field stock shortages. July reports to the factories likewise are that business was good and would have been better if more cars had been available. The dealers are obviously going into the period of factory changeovers with exceptionally low stocks on hand, preliminary to a complete sell-out before initial 1942 model introductions come in August and September.

[1] 1923 average = 100; [2] Prepared by Administrative and Research Corp. of New York. 1926 = 100; [3] Estimated at the Detroit office of AUTOMOTIVE INDUSTRIES.

OPM-OPACS Reach Truce, But New Cut Not Fixed Yet

General Statement from Washington Meeting Says Tentative Schedules Are Too High and Probably Will Need Adjustment

Curtailment of automobile production in the first three months of the 1942 model year will be slashed beyond the original 20 per cent cut, but how much continues to remain unsettled. What may come after that is even more problematical.

The slash below 600,000 passenger cars in August, September and October is taken to be a certainty following a meeting in Washington on July 29 when OPM Director General William S. Knudsen and OPACS' Leon Henderson were "hosts," as a joint statement put it, at a luncheon attended by members of those two agencies and representatives of the manufacturers.

The deepening of the first quarter cut below the 20 per cent originally set was interpreted to mean that OPACS, which wants a 50 per cent curtailment after that period, was victor in its preliminary skirmish with OPM in a jurisdictional dispute with OPM opposing the sharper reduction in output. The issue has been put up to President Roosevelt for final determination.

The statement said that it was the "general feeling of the Government representatives present that the industry's tentative production schedules were too high and would probably have to be adjusted."

More Defense Contracts

This significant statement, although vague, was followed by the observation that all of the companies represented are working closely with OPM in an effort to secure additional defense contracts for their growing organizations and productive facilities. The industry was asked to furnish additional information on both truck production and the timing of the transfer of labor to the $2 billions of defense work the automobile industry has already undertaken. Further work, it was pointed out, is being carried on regarding the elimination of critical materials "even though the industry has made an unusually fine record in substitution today."

Knudsen and Henderson presided jointly at the meeting, and after saying some nice things about the cooperative spirit of the industry, they announced that OPM and OPACS would confer further concerning the problems.

It was added that a preliminary canvass of business available to the industry through defense contracts, motor truck production and the passenger car production for which materials are likely to be available, indicates a quite considerable total volume business for the industry during the coming model year. Representatives of the passenger car industry were informed that as soon as the necessary information has been compiled prompt action on allocation will be taken.

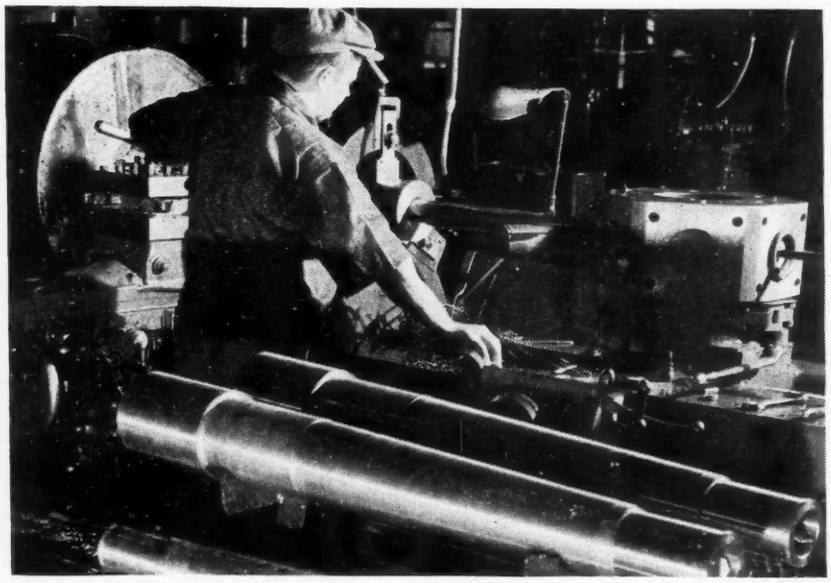
The joint meeting was the climax to the OPM-OPACS controversy that began assuming the proportions of a major dispute despite official efforts to minimize the differences between OPM, charged with supplying defense requirements, and OPACS, charged with civilian allocations and price stabilization. However, the row between the two organizations reached the point of open hostility when Henderson suddenly announced his drastic curtailment edict, which also resulted in manufacturers, CIO labor leaders and Gov. Murray D. Van Wagoner of Michigan rushing to Washington to protest.

President Roosevelt saw no discord in the OPACS announcement. Characteristically, the President minimized reports that a controversy over jurisdiction between the two agencies was raging, and offered the explanation that the OPACS proposal merely involves a 50 per cent curtailment of materials now going into automobile production, and might not mean an equivalent reduction in automobile output if industry found suitable substitutes.

Negotiated Basis

Mr. Knudsen said that any final curtailment recommendations will be negotiated "in a cooperative way," and that James S. Adams, head of the OPM Automobile Commodity division, will make the final decision on the extent and manner of reduced production after receiving recommendations from the industry itself, from Mr. Henderson's OPACS and from experts at OPM.

OPM and OPACS, however, united at that time in telling automobile makers and the CIO-UAW that the industry may produce about 600,000 passenger cars in the first three months of the new model year beginning Aug. 1, equivalent to 80 per cent of the 1940 rate of output. The first quarter rate was termed a "cushioning period" or a breathing spell for which management and labor was asked to assume responsibility pending increased conversion to defense output.



From Street Car Motors to Howitzers

Because these 75-mm. pack howitzer barrels are only 47-in. long they are being machined almost entirely by General Electric equipment that once was used to manufacture electric motors for street cars and locomotives. Only the rifling needed special equipment.

Spark Plug Indicator for Navy Airplanes

The Bureau of Standards, which during the World War developed an improved grade of porcelain for use in spark plug insulators, has completed tests for the Navy on a dashboard indicator by which an airplane pilot can tell at a glance whether any particular one of the spark plugs of his engine is functioning properly. If the indicator shows the plug to be too hot, it may be due to the surface of the insulator being fouled with lead. This can be corrected by reducing the richness of the fuel mixture. If, on the other hand, a plug shows up too cold, it indicates the presence of carbon deposit on the insulator. This can be corrected by increasing the speed of the engine, thereby raising the temperature of the insulator and burning off the carbon.

OPM Plans to Scrap Millions of Old Cars

OPM has announced a program to scrap millions of old cars for conversion into iron and steel scrap. A committee of auto wreckers and scrap dealers were scheduled to meet on July 30 in Columbus, Ohio, to perfect the plan. The objective is to increase by at least 1,000,000 tons of scrap "and possibly many times more." About 2,500,000 cars are now scrapped annually. There is an acute shortage of iron and steel scrap.

Studebaker Net Earnings

Consolidated net profit of the Studebaker Corp. for the second quarter of 1941 amounted to $1,133,417 as compared with $445,806 earned in the same period of 1940. For the six months ended June 30, 1941, total consolidated net profit was $1,313,877 as compared to $957,309 for the same 1940 period.

European

Recce Cars in Action

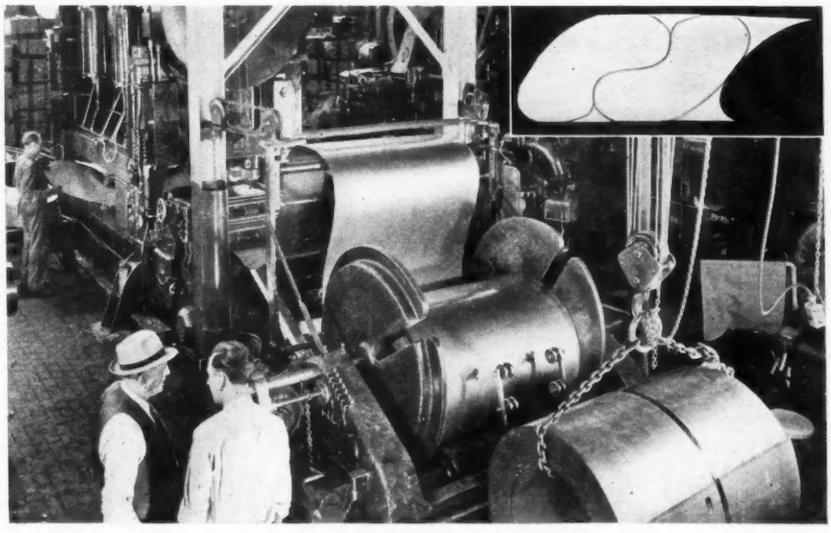
Britain's modern cavalry mounts these light but well-armed reconnaissance (Recce) cars to carry out important scouting functions. These are in training in Northern Ireland.

Chevrolet Begins Retooling For P & W Aircraft Engines

Closing of Buffalo Plants Necessitates Dislocation of Workers; Huge Defense Orders Flow Throughout Industry

Abrupt dislocation of automotive workers in anticipation of the switchover to defense production was no more apparent, end of last month, than in Buffalo when shut down of Chevrolet's big River Road plant caused at least temporary unemployment for most of its 3500 workers. Only the truck rear axle division is kept opened and this operation is of dubious tenure.

Tooling is already under way for the big task of converting the plant for the manufacture of Pratt & Whitney aircraft engines under the recent Chevrolet Government contract for $89,075,000. "We are retaining the engineering force and the tool and die makers," said Alfred G. Gulliver, factory manager. "When we start operations on the defense program all our employes will have the opportunity to return." Meanwhile the Chevrolet assembly plant and the Fisher body plant, also in Buffalo, were expected to shut down at the end of July, affecting 1500 more workers.



Steel in Rolls for Economy

Steel in continuous sheet form provides economy of material as well as speed for this Chevrolet fender blanking press. Insert shows how patterns are interlocked for greatest saving. Even the triangles can be used for smaller stampings

Continental Motors Corp.

Continental Motors Corp. delivered approximately 50 Wright Whirlwind nine-cylinder engines to the government during July to power medium tanks and training planes for the U. S. Army. Continental began production early in the month on a $40,000,000 order for more than 9000 of these engines, which are being built in Continental's Detroit plant. Renovation of this plant was begun last fall after having been unoccupied for a year and the retooling for defense production was completed early in July. Some of the machinery originally was intended for use in France but later was diverted to Continental.

Status of Continental's tank and air-

(*Turn to page 72, please*)

Business in Brief

***Written by the Guaranty Trust Co., New York, Exclusively for* AUTOMOTIVE INDUSTRIES**

Moderately reduced business activity was indicated early this month. The seasonally adjusted index of The New York *Times* for the week ended July 12 declined to 128.6 per cent of the estimated normal, as against 130.5 for the preceding week and the all-time peak of 132.8 for the last full week in June. The index of *The Journal of Commerce*, without adjustment for seasonal variation, for the same period registered a similar decline to 120.5 per cent of the 1927-29 average from a peak of 124.9 a fortnight earlier.

Department store sales during the week ended July 12, according to the Federal Reserve compilation, exceeded by 19 per cent the corresponding total last year, as against a similar excess of 28 per cent for the week before.

Contracts awarded for heavy construction during the week ended July 17, according to *Engineering News-Record*, totaled $206,765,000, approximately 30 per cent less than the all-time peak reported for the preceding week but 21 per cent greater than the amount a year ago.

The movement of railway freight during the week ended July 12 canceled in part the decline reported for the week that included Independence Day. Loadings totaled 876,165 cars, 18.3 per cent more than in the week before and 18.9 per cent above the comparable number last year.

Electric power production in the week ended July 19 rose to an all-time peak, 18.0 per cent greater than the output a year ago, as against a similar gain of 18.5 per cent a week earlier.

Business failures during the week ended July 17 numbered 193, as compared with 184 in the preceding week and 288 a year ago, according to the Dun & Bradstreet report.

Crude oil production in the week ended July 19 averaged 3,676,050 barrels daily, 194,700 barrels less than the average a week earlier and 171,050 barrels below the currently required output as computed by the Bureau of Mines.

Average daily production of bituminous coal for the week ended July 12 was 1,554,000 tons, as against 1,355,000 tons in the preceding week and 1,382,000 a year ago.

Cotton mill activity in the same period declined contra-seasonally; and The New York *Times* adjusted index dropped to 174.1 per cent of the estimated normal, as compared with 193.7 a week earlier and 116.5 for the corresponding week last year.

Professor Fisher's index of wholesale commodity prices, registering a new peak for the year, stands for the week ended July 18 at 95.4 per cent of the 1926 average, as against 95.1 for the preceding week.

Member bank reserve balances increased $252 millions during the week ended July 16, and estimated excess reserves rose $220 millions. Business loans of reporting members increased $55 millions and stood on that date $1524 millions above the corresponding amount last year.

New Test Laboratory for Standards Bureau

The properties of metals and alloys, their fabrication and welding, will be under study in the Bureau of Standards new $500,000 materials testing laboratory to be constructed shortly. The new building also will house increased facilities for the calibration of precision gages used in the control of mass production of munitions, for the studies of fuels, lubricants and ignition problems, for the testing of aeronautic instruments, auxiliary aircraft equipment and other military supplies.

CALENDAR

Conventions and Meetings

Natl. Petroleum Assoc., Atlantic City, Sept. 17-19
Society of Automotive Engineers, National Tractor Meeting, Milwaukee, Sept. 25-26
Natl. Lubricating Grease Inst., Chicago, Sept. 29-30
Natl. Safety Council, Chicago....Oct. 6-10
Exposition of Power & Mechanical Engineering, Chicago .....Oct. 6-11
Amer. Society of Tool Engineers, Toronto, Canada .....Oct. 16-18
National Metal Congress and Exposition: Cooperating societies—American Society for Metals, Wire Association, American Welding Society, Institute of Metals and Iron and Steel Divisions of American Institute of Mining and Metallurgical Engineers, Philadelphia .....Oct. 20-24
SAE Natl. Fuels & Lubricants Mtg., Tulsa, Okla. .....Oct. 23-24
Society of Automotive Engineers, Aircraft Production Meeting, Los Angeles .....Oct. 30-Nov. 1
SAE West Coast Transportation Mtg., San Francisco .....Nov. 5-6
SAE Natl. Transportation & Maintenance Mtg., Cleveland.....Nov. 13-14
National Assoc. of Manufacturers, New York City .....Dec. 3-5

Shows

Automobile Accessories Association Show, Chicago .....Aug. 4-7

Robert C. Farrington

Robert C. Farrington, 59, chief mechanical engineer of the Austin Co., engineers and builders, since 1919, died at St. Joseph's Hospital, Fort Worth, Tex., on July 15.

Robert Crawford

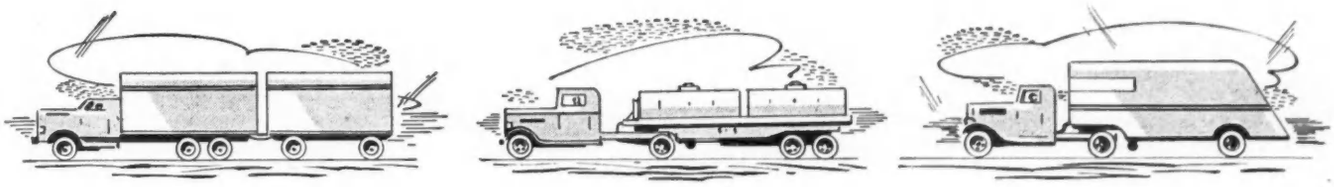
Robert Crawford, 59, Highland Park, Ill., a pioneer in the automobile industry, at one time sales manager for the Haines Automobile Co., and later president of the Sun Motor Car Co., died in Indianapolis July 10 of a heart attack.

New Passenger Car Registrations

	MAY 1941*	APRIL 1941	MAY 1940	FIVE MONTHS 1941*	FIVE MONTHS 1940	Per Cent Change, 5 Months, 1941 over 1940	Per Cent of Total Five Months 1941	Per Cent of Total Five Months 1940	EIGHT MONTHS MODEL YEAR 1941	EIGHT MONTHS MODEL YEAR 1940	EIGHT MONTHS MODEL YEAR Per Cent Change
Chevrolet	121,411	120,879	87,895	493,153	378,624	+ 30.0	24.42	25.31	725,454	588,190	+ 23.1
Ford	76,854	63,009	55,147	310,956	245,540	+ 26.9	15.40	16.41	455,741	389,911	+ 17.0
Plymouth	66,290	63,571	46,655	250,171	194,705	+ 28.5	12.39	13.01	366,784	269,280	+ 36.5
Buick	42,311	44,167	27,136	172,346	120,308	+ 43.1	8.53	8.04	261,359	198,422	+ 31.8
Pontiac	39,889	41,187	23,274	161,776	97,223	+ 65.2	8.01	6.50	233,351	156,239	+ 49.0
Oldsmobile	33,551	33,917	20,400	132,156	85,251	+ 55.0	6.54	5.70	192,413	138,773	+ 38.4
Dodge	29,948	27,985	21,251	112,318	93,614	+ 20.0	5.56	6.26	155,976	127,753	+ 22.2
Chrysler	21,607	19,239	10,345	77,572	44,691	+ 73.2	3.84	2.99	105,174	60,760	+ 73.0
Studebaker	14,315	12,701	10,199	53,037	42,709	+ 24.0	2.63	2.85	79,955	69,883	+ 14.4
De Soto	13,611	11,666	7,032	46,492	30,896	+ 50.2	2.30	2.06	64,411	42,764	+ 50.3
Nash	11,265	10,893	5,196	43,805	24,332	+ 80.0	2.17	1.63	56,930	39,002	+ 46.0
Mercury	10,807	9,133	8,117	42,673	37,052	+ 15.3	2.11	2.48	62,269	59,070	+ 5.5
Hudson	9,963	9,808	7,973	37,599	33,990	+ 10.5	1.86	2.27	57,993	58,160	- 0.3
Cadillac	8,110	7,928	3,370	32,121	15,068	+114.0	1.59	1.01	46,000	26,334	+ 75.0
Packard	8,650	7,723	6,978	31,456	31,096	+ 1.3	1.56	2.08	50,000	52,810	- 5.1
Willys-Americar	3,074	2,319	2,025	10,613	9,380	+ 13.1	.53	.63	15,459	15,288	+ 1.2
Lincoln	2,426	2,042	1,879	9,491	9,381	+ 1.1	.47	.63	14,954	15,233	- 2.0
Graham	54	77	207	421	406	+ 3.5	.02	.03	952	719	+ 32.6
Crosley	68	55	28	219	228	- 4.0	.01	.01	330	363	- 9.0
Bantam	6	18	81	81	455	- 82.2	.....	.03	180	687	- 73.8
Miscellaneous	268	149	560	1,137	1,250	- 9.1	.06	.07	2,283	1,857	+ 23.0
Total	514,478	488,460	345,748	2,019,593	1,496,199	+ 35.0	100.00	100.00	2,947,968	2,311,498	+ 27.5
Chrysler Corp.	131,456	122,461	85,283	486,553	363,906	+ 33.9	24.09	24.32	692,345	500,557	+ 38.2
Ford Motors	90,087	74,184	65,143	363,120	291,973	+ 24.4	17.98	19.52	532,964	464,214	+ 15.0
General Motors Corp.	245,272	248,078	162,075	991,552	696,474	+ 42.3	49.10	46.55	1,458,577	1,107,958	+ 32.2
All Others	47,663	43,737	33,247	178,368	143,835	+ 24.0	8.83	9.61	264,082	238,769	+ 10.5

* In addition to data shown there were 556 Federal Government deliveries during May and a total of 4218 to date.

Warner ELECTRIC BRAKES
for National Defense...

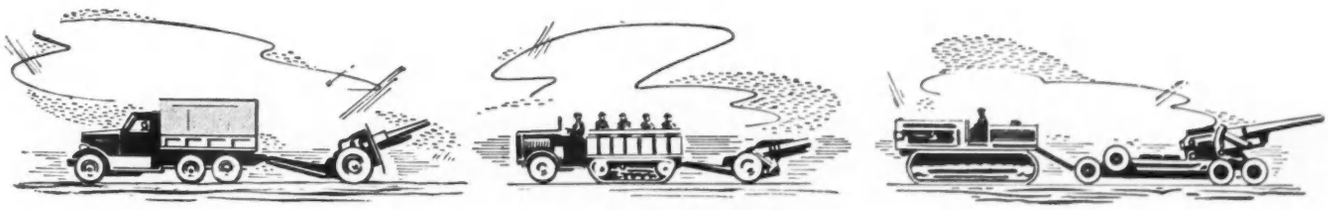


WARNER ELECTRIC BRAKES have been adopted for use on gun carriages and other mobile equipment for the U. S. armed forces.

Likewise, for years, tractor-trailer operators from coast to coast have chosen WARNER ELECTRIC BRAKES for their "service-proved" efficiency and dependability.

For any trailing equipment specify WARNER ELECTRIC BRAKES, the only brakes designed expressly for trailers. Write for complete information.

WARNER ELECTRIC BRAKE MFG. COMPANY
BELOIT · WISCONSIN



International

Valentines for Hitler

Well-armed British tanks of the "Valentine" type have been maneuvering lately in offensive formations. With hatches battened down for rough going they present a formidable threat to Nazi-occupied Europe.

Change-Over Period May Ease Demand for Steel

But Benefits Are Offset by Increase in Plate Production; Freight Cars vs. Tanks Become Major Priority Problem

By W. C. Hirsch

To what extent the model change-over period will lighten pressure on rolling and finishing mill capacity depends largely upon how many more of the continuous sheet and strip mills are slated to be diverted to the production of plates. Demand for the latter has become all the more insistent since scarcity of freight cars and the danger of resulting freight tie-ups have become front-page subjects.

Admitting that an adequate supply of freight cars is essential to the maintenance of the country's transportation system, should steel plates for their construction have the right of way over those needed in the manufacture of tanks that are the backbone of land defense? This is only one instance of the steadily growing difficulty of determining what priorities should take precedence over other priorities. Steel orders with a high priority rating are shipped within two to three months following receipt of specifications. Commitments of a strictly civilian character probably will not move to buyer's plants until next winter, and, if defense requirements for the particular descriptions of steel sought mount unexpectedly, may have to be laid over indefinitely.

In spite of all this uncertainty, steel buyers, both those with and without priority ratings, continue to add to the unfilled tonnage on the mills' order books. Naturally the steel industry operates at close to capacity, minor deviations from this rule being ascribed either to the necessity of reconditioning equipment or to "wild cat" labor disruptions, such as impeded produc-

(*Turn to page* 68, *please*)

New Truck Registrations

	May* 1941	April 1941	May 1940	FIVE MONTHS 1941*	FIVE MONTHS 1940	Per Cent Change, 5 Months 1941 over 1940	Per Cent of Total Five Months 1941	Per Cent of Total Five Months 1940
Chevrolet	22,332	22,497	16,735	97,461	82,886	+ 17.6	33.40	34.05
Ford	17,290	16,789	13,769	85,069	69,329	+ 22.7	29.16	28.48
International	9,023	9,129	6,715	41,093	31,100	+ 32.1	14.08	12.78
Dodge	6,012	6,038	5,453	26,041	25,137	+ 3.6	8.92	10.33
G. M. C.	4,224	4,267	3,704	18,947	16,335	+ 15.9	6.49	6.71
Plymouth	1,066	1,041	1,064	4,743	4,568	+ 3.8	1.63	1.88
White	811	918	562	3,851	2,694	+ 42.9	1.32	1.11
Mack	903	931	756	3,835	2,940	+ 30.4	1.31	1.21
Diamond T	561	701	501	2,728	2,597	+ 5.0	.94	1.07
Studebaker	434	475	112	1,754	585	+199.8	.60	.24
Autocar	228	250	156	1,021	679	+ 50.4	.35	.28
Divco	213	217	187	946	791	+ 19.6	.32	.32
Brockway	244	229	143	931	577	+ 61.4	.31	.24
Willys-Americar	252	186	225	770	1,035	- 25.6	.26	.42
Federal	156	137	151	661	729	- 9.3	.23	.30
Reo	157	154	6	618	34	+1717.6	.21	.01
Hudson	84	94	92	391	375	+ 4.3	.14	.15
Sterling	43	48	25	193	137	+ 40.9	.07	.06
F. W. D.	16	18	25	109	127	- 14.2	.05	.05
Bantam	3	7	41	29	234	- 87.6	.01	.10
Miscellaneous	125	110	121	589	522	+ 12.8	.20	.21
Total	64,177	64,236	50,543	291,780	243,411	+ 19.9	100.00	100.00

* In addition to these data there were 7993 Federal Government deliveries during May and a total of 36,069 for the first five months of 1941.

More Defense Contracts for Parts Manufacturers

Promises that manufacturers of automobile parts and components will be given a greatly increased volume of defense work have been made by OPM. At the same time OPACS has granted priority status to materials and equipment necessary to maintain the operation of passenger automobiles, trucks and tractors.

Some 120 members of the automobile parts industry, who met in Washington to nominate eight members of the Automotive Defense Industry Advisory Committee, were told by OPM Director General William S. Knudsen that additional defense work must be placed in plants now manufacturing consumers' durable goods to get the defense program, now grown to nearly $60 billions, out on time.

The OPACS action giving priority status to materials necessary for insuring automobile maintenance was prompted by the expectation that the defense program will make it increasingly difficult to expand or even maintain existing supplies of new durable consumers' goods.

Metal Congress Goes All Out for Defense

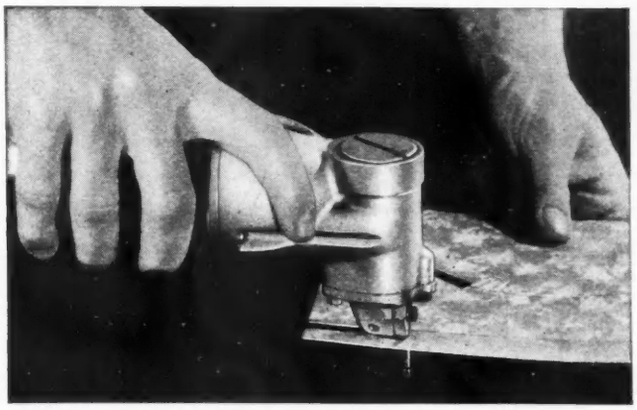
The "low-down" on national defense is expected to provide the principal theme for the 23rd annual Metal Congress and Exposition to be held in Philadelphia during the week of October 20th, when over 275 manufacturers will exhibit their products.

"This year's Congress is going 'all out' for defense," said W. H. Eisenman, managing director of the Congress and secretary of the Metals Society, "giving the nation's defense producers a chance to take stock of their progress.

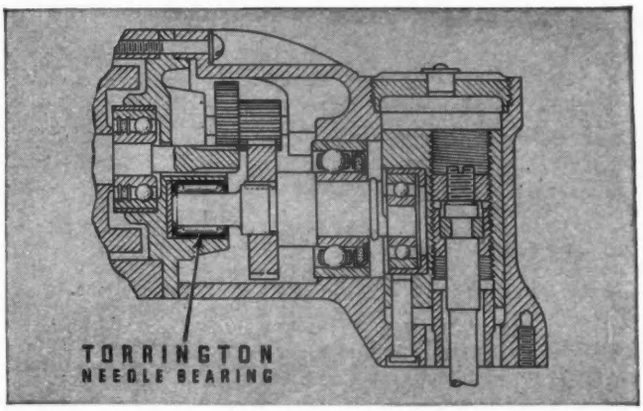
Ralph S. Cooper

Ralph Stewart Cooper, retired president of the Independent Pneumatic Tool Co., Chicago, died at White Plains, N. Y., on July 13. Since his retirement six years ago, he had lived at Scarsdale, N. Y.

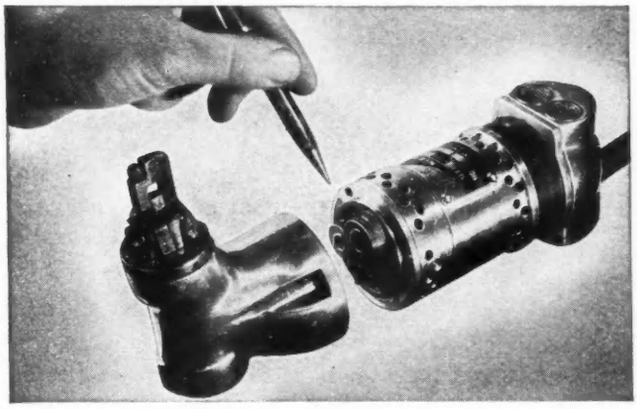
Thor CUTS SIZE AND WEIGHT OF POWER TOOLS WITH ANTI-FRICTION NEEDLE BEARINGS



THIS COMPACT THOR hand-model U1N Nibbler packs in plenty of power! It weighs only 3¾ lbs., yet does the work of a portable power shear and, in addition, efficiently cuts irregular shapes, follows lines and contours, and even cuts inside shapes on a radius as small as 1½ in., starting at a drill hole.



HOW IS IT MADE JUST A HANDFUL? Here's what Mr. G. Larson, Chief Designer of Independent Pneumatic Tool Co., says: "The Torrington Needle Bearing's very small O.D. makes possible our compact gear case. And it gives us good anti-friction service without trouble, in the Nibbler and many other tools."



THE NEEDLE BEARING (indicated by Mr. Larson's pencil) is fairly inaccessible when the tool is assembled, but no extra lubrication system is necessary because a large supply of grease is retained and evenly distributed in the reservoir formed by the close-fitting lips of the bearing's race.

OPERATING AT HIGH SPEEDS the Torrington Needle Bearing shows its ruggedness on jobs like this. Its precision-ground rollers and hardened outer race form a self-contained unit of high radial load capacity that is easily, inexpensively installed in almost any type housing. Initial cost is also surprisingly low.

If you have a bearing problem where high load capacity, small size, light weight, ease of assembly and lubrication are vital considerations, and low cost is an important factor, investigate the Torrington Needle Bearing. Our Engineering Department will

be glad to work with you in adapting its advantages to your product. For details, write for Catalog No. 117. For Needle Bearings to be used in heavier service, write our associate, Bantam Bearings Corporation, South Bend, Indiana, for Booklet 103X.

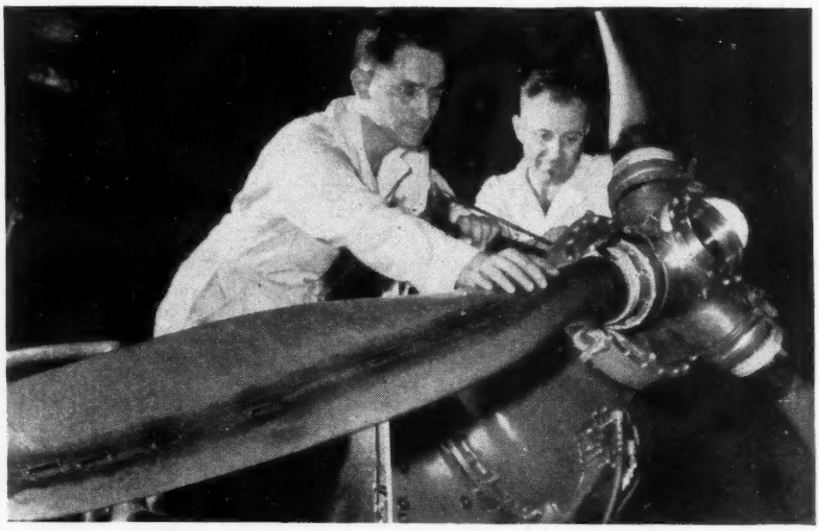
THE TORRINGTON COMPANY, TORRINGTON, CONN., U. S. A. · ESTABLISHED 1866

Makers of Needle and Ball Bearings

New York Boston Philadelphia Detroit Cleveland Chicago London, England

1866 75 YEARS OF MANUFACTURING PRECISION PRODUCTS 1941

TORRINGTON NEEDLE BEARING



GM Suppresses Stresses

As General Motors' new Aeroproducts Division at Dayton, Ohio, gets into production its new hydraulic propellers are put through exacting tests. Most important is the measurement of vibration stresses. Tiny carbon resistance, which may be seen cemented to the blade surfaces are wired to a slip ring assembly at the hub and thence to accurate gages. Stresses due to vibration can be measured throughout the entire speed range and then completely eliminated. Thus is wiped out a primary cause of propeller failure which until recent years was attributed to "causes unknown." Other tests include 100 hours at full throttle and 2000 cycles of speed variations and 500 cycles of power variations.

Aeroproduct propeller blades are of light weight, hollow construction and are made of heat-treated, gear steel. Accurate hydraulic regulation permits full feathering as well as automatic regulation of pitch for all load conditions.

The propeller hub is so designed that the effect of centrifugal force on the propeller mechanism balances the blade torque at the safest operating angle. The hub design also permits the center mounting of a cannon for firing through an unrestricted hole in the center of the propeller shaft.

Exports and Imports of the Automotive Industry for May

	MAY				FIVE MONTHS ENDED MAY			
	1940		1941		1940		1941	
	No.	Value	No.	Value	No.	Value	No.	Value
EXPORTS								
Automobiles, parts and accessories		$ 21,337,197		$ 33,510,652		$ 117,472,189		$ 137,649,066
Passenger cars and chassis	9,207	5,813,707	8,782	6,147,380	51,010	31,693,063	39,244	27,199,853
Low price range $850 inclusive	8,186	4,726,288	7,342	4,220,43.	44,992	25,450,110	32,187	19,348,787
Medium price range over $850 to $1200.	863	835,691	1,101	1,073,343	5,214	4,956,950	5,855	5,622,465
$1200 to $2000	142	204,861	199	223,750	727	1,054,641	1,004	1,400,241
Over $2000	22	76,867	140	629,856	77	221,392	198	828,360
COMMERCIAL VEHICLES								
Motor trucks, buses and chassis (total)	7,832	6,995,468	12,910	13,659,787	50,459	41,194,877	53,849	54,075,468
Under one ton	756	366,614	1,394	776,924	6,951	3,161,714	4,332	2,301,665
One and up to 1½ tons	5,855	3,089,337	7,072	4,467,549	31,769	17,478,578	33,335	20,589,010
Over 1½ tons to 2½ tons	704	814,606	2,609	3,112,449	8,089	10,704,075	7,159	8,436,185
Over 2½ tons	512	2,701,956	1,833	5,294,200	3,535	9,688,900	8,972	22,688,387
Bus chassis	5	12,957	3	8,665	106	161,610	51	60,221
PARTS, ETC.								
Parts except engines and tires		3,544,694		5,686,433		19,769,482		30,419,427
Automobile unit assemblies		3,513,638		3,406,66.		17,931,578		18,162,134
Automobile parts for replacement (n.e.s.)		493,666		413,239		1,980,641		2,601,287
Other automobile accessories (n.e.s.)		370,239		413,651		1,758,780		1,658,405
Automobile service appliances								
Airplanes, seaplanes and other aircraft (powered)	295	13,998,832	517	10,742,631	1,090	71,556,235	2,366	161,629,708
Parts of airplanes, except engines and tires (n.e.s.)		1,888,998		4,557,006		9,514,243		17,059,176
INTERNAL COMBUSTION ENGINES								
Stationary and Portable								
Diesel and semi-Diesel (other than automotive)	74	368,677	236	667,254	389	1,279,477	737	1,971,356
Other stationary and portable								
Not over 10 hp.	1,208	68,092	2,114	121,253	6,557	380,566	8,404	537,058
Over 10 hp.	187	260,079	11,538	122,818	1,057	1,362,764	12,333	1,165,781
Accessories and parts (carburetors)		436,106		560,737		1,862,215		2,370,823
Engines for:								
Motor trucks and buses	1,715	207,955	2,145	219,034	10,161	1,118,013	9,796	1,092,087
Passenger cars	862	80,840	1,182	184,723	9,543	862,452	4,791	609,184
Aircraft	397	3,408,915	490	3,230,777	1,694	14,581,641	3,384	39,217,861
IMPORTS								
Automobiles (dutiable)	45	51,745	45	18,336	21	271,22	17	107,749

Truck and Bus Inventory To Be Started Next Month

Pertinent information needed in planning the use of motor trucks and buses in any emergency will be collected through the medium of a nationwide inventory to be sent to all truck and bus owners early in September. Owners will be asked to fill in a separate card for each vehicle stating its type, size, age, etc.

The Public Roads Administration has planned the procedure for the inventory and its representatives will cooperate with state motor vehicle registration agencies in compiling the list of owners. The Works Progress Administration will furnish assistance where needed in mailing the questionnaires and assembling the returns.

PUBLICATIONS

A catalog, No. 41, illustrating and describing its line of **pneumatic tools** for industrial use, has been issued by the Aro Equipment Corp.*

Two manuals on **high-alloy steels** have been released by the Allegheny Ludlum Steel Corp. One covers tool steel and the other stainless steel.*

A handy-size catalog on **Joyce Jacks** has been released by the Joyce-Cridland Co. It illustrates and describes, with complete specifications, 289 different models and sizes of jacks.*

Integral gear units for generators, compressors, pumps, lineshafts and other equipment to be driven slower than efficient turbine speeds are described in a new 4-page folder by Westinghouse Electric & Mfg. Co.*

Book 1975, Link-Belt Co., entitled **New Bulk-Flo,** describes its new power-operated conveyor system for the handling of loose materials of 1 to 140 tons per hour.

John S. Barnes Corp. has issued a new bulletin announcing an improved **solenoid** designed primarily for machine tool use.*

B. F. Goodrich Co. has announced two more catalog sections: No. 4030, **High Pressure Hydraulic Control Hose** and No. 9790, **Milled Sponge Rubber.***

A series of 14 booklets for training operators in the setup and operation of its **automatic screw machines** has been issued by the Brown & Sharpe Mfg. Co., Providence, R. I. The complete series is priced at 50 cents.

The Neoprene Notebook, No. 30, has been released by the Rubber Chemicals Division of E. I. duPont DeNemours & Co. In the issue is an article on Neoprene tires.*

The Bristol Co. announces catalog No. 572, on **time cycle controllers** for plant process operations, and two bulletins, one on **steel belt lacing** for joining or repairing machine and conveyor belts and one on **socket screws.***

The July issue of Repaint Reporter, published by Ditzler Color Co., contains information on **appearance reconditioning of automobiles.***

Wells Mfg. Corp.'s latest folder on its **Metal Cutting Band Saws** describes and illustrates models Nos. 5 and 8.*

An illustrated catalog on its 9-in. **precision lathes,** Models A, B and C, has been announced by South Bend Lathe Works.*

The Burd Piston Ring Co., Rockford, Ill., has issued the 1st edition of the Automotive Serviceman's Handy Hand Book designed for use by automobile mechanics. Price is 50 cents a copy.

*Obtainable through editorial department, AUTOMOTIVE INDUSTRIES. Address Chestnut and 56th Sts., Philadelphia. Please give date of issue in which literature was listed.

You know what you want from your cutting tools. Here's what users are getting from molybdenum high speed steels, in comparison with the tungsten types.

Equivalent cutting properties Greater toughness Lower cost

These are facts — with nine years' experience in thousands of shops to back them up. Check cost and performance records with any user you like. See your supplier for the proper analysis and heat treatment for your requirements.

CLIMAX FURNISHES AUTHORITATIVE ENGINEERING DATA ON MOLYBDENUM APPLICATIONS.
MOLYBDIC OXIDE—BRIQUETTED OR CANNED • FERROMOLYBDENUM • CALCIUM MOLYBDATE

Climax Mo-lyb-den-um Company
500 Fifth Avenue • New York City

MOLY

Lubri-Zol Has New Laboratory

(*Continued from page* 31)

10—Air-cooled single cylinder engines
2—Torque Products water brakes
1—Taylor Hi-Eff water brake
3—175 hp. Induction-type dynamometers
1—Chevrolet car, set up on treadmill for impact loading
1—Chassis dynamometer, equipped with 400 hp. induction-type dynamometer
1—75 hp. electric dynamometer
1—100 hp. electric dynamometer
1—SAE film strength machine
1—Timken lubricant tester
1—Fayville Levally lubricant tester
2—Cormen lubricant testers
1—Shell 4-ball lubricant tester

The foregoing is intended as a brief but comprehensive outline of the new plant from the standpoint of physical equipment and operating philosophy. It is apparent that no effort has been spared to provide a true scientific background for the development of chemical products which have such an important bearing upon the economical functioning of modern automotive equipment for stationary work, for road transportation, for air transport.

Much of the activity of the laboratory has been translated into technical reports for presentation to engineers, metallurgists and operators in various fields. A brief summary of recent technical reports is given below:

Show Motor Oil Varnish Tendencies with Single-Cylinder Test Engines —National Petroleum News, Sept. 4, 1940.

Use of Small-Scale Single-Cylinder Engines for the Evaluation of Motor Oils, by A. O. Willey and C. F. Prutton, SAE Summer Meeting, 1940.

Hypoid Gear Lubrication, by C. F. Prutton and A. O. Willey, National Lubricating Grease Institute, October, 1939.

Hypoid Lubricants, by C. F. Prutton and A. O. Willey, S.A.E. Fuels and Lubricants Meeting, Tulsa, November, 1939.

Testing of Hypoid Lubricants, by C. F. Prutton and A. O. Willey, SAE Journal, August, 1938.

Improved Motor Oils (Technical Bulletin, 1941).

Lycoming Production

(*Continued from page* 25)

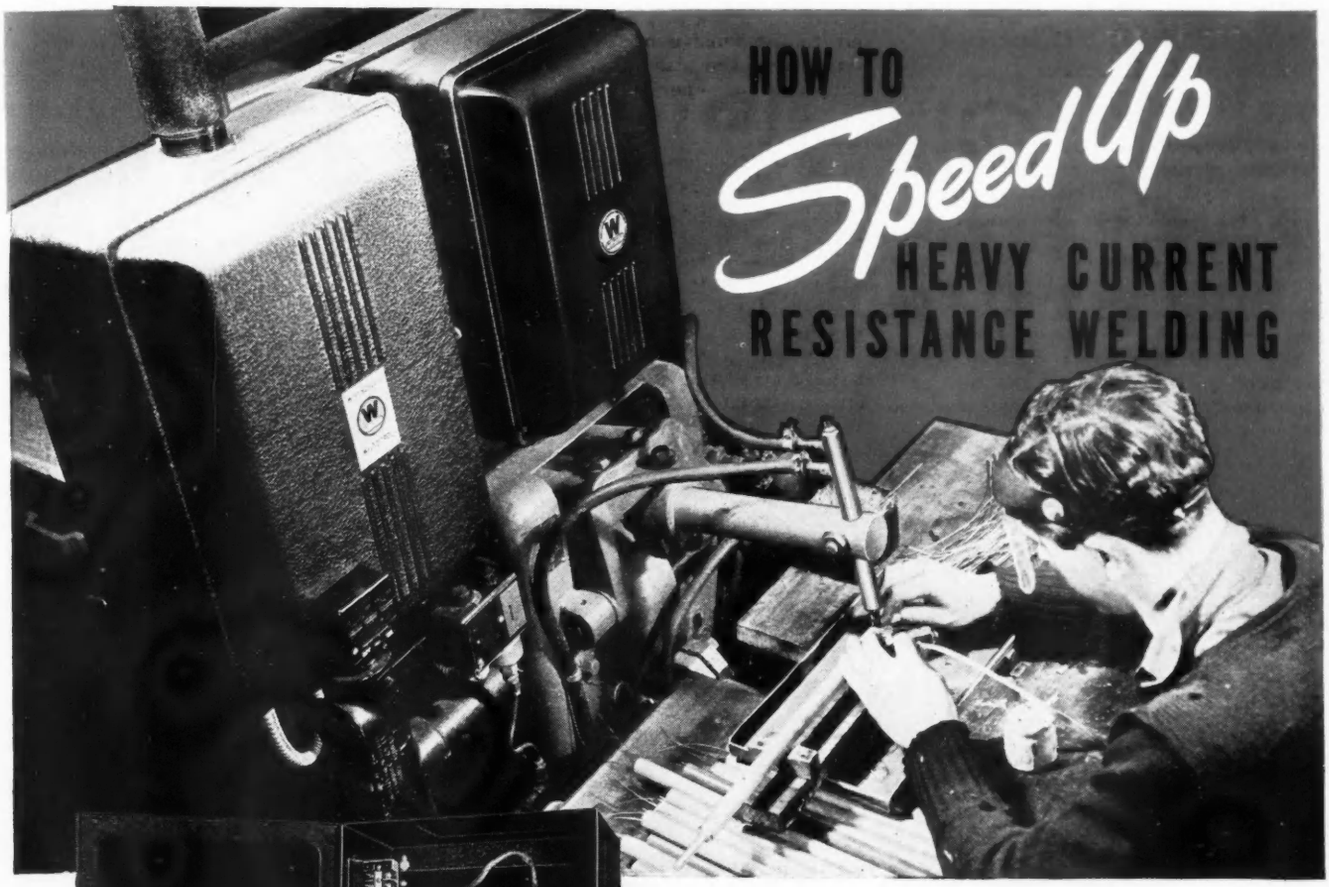
of the procedure and will serve as an inventory of much of the major items of equipment found in this department. Moreover, the pictorial section provides an excellent cross-section of machines and tooling now in use.

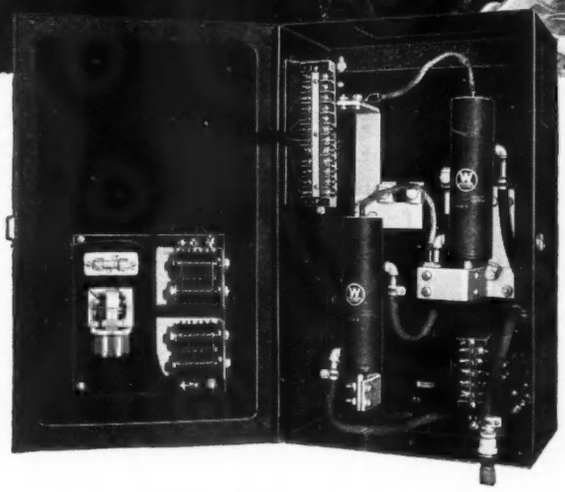
It should be noted that the routing for the right hand case reproduced here, covers all of the operations common to both the right and left hand cases, including the final steps after both cases have been assembled together.

Commercial engines are assembled in conventional fashion, then run-in initially on electric break-in stands. For this purpose, there is a battery of twenty stands. After break-in the commercial engines are routed to the test cells, of which there are eight units, for a brief standard test schedule.

Spark Plug Threads in Light Metals

When a spark plug has to be secured into the wall of a cylinder or cylinder head cast of a light alloy, it is customary to insert a bushing of some stronger material. To obviate the need for such a bushing, a German firm has patented a special thread for spark plugs and spark-plug holes. Both the spark plug and the hole for it are cut with a relatively coarse V thread, the thread in the light metal has the top half removed, and the thread on the plug the groove is filled up with metal to half its depth. Only the top half of a normal V thread is used on the plug and the bottom half in the light-metal part. For a given radial depth of thread this gives a much stronger thread in the light-metal part.





WELD-O-TROL PAYS DIVIDENDS

- **IN TIME:** saves man-hours required for maintenance.
- **IN PRODUCTION:** allows greater effective production time.
- **IN WELD QUALITY:** enables resistance welding of many nonferrous metals; produces more uniform, stronger welds.

. . . ADD WELD-O-TROL . . .

THE FAST, SILENT POWER SWITCH

WITH NO MOVING PARTS

Weld-O-Trol, the power switch with *no moving parts,* eliminates the mechanical limitations on high speed, heavy current resistance welding.

Installed with existing welder-timer equipment, it steps up production because of fewer maintenance outages. It operates on the electronic valve principle, without mechanical contacts, and eliminates frequent maintenance delays and replacement costs.

Weld-O-Trol is a lightweight, compact unit, easily installed with your present equipment. Bulletin F-8451-A contains the complete Weld-O-Trol story. Send for your copy today. WESTINGHOUSE ELECTRIC & MANUFACTURING CO., EAST PITTSBURGH, PA., DEPT. 7-N.

J-21151

Westinghouse

WELD-O-TROL

Nickel Steel Substitutes

(*Continued from page 37*)

materially affecting the ductility. In the case of the 5 per cent nickel steel 2512, two of the alternates proposed, 3315 and 4320, have higher tensile strength and yield point than the metal they are to replace.

The thorough-hardening alloy steels most commonly used may be divided into three distinct classes, as follows:

(1) Steels with from 0.25 to 0.35 per cent carbon, used in the oil- or water-hardened state within a tensile-strength range of 100,000 to 150,000 lb. per sq. in. and a Brinell hardness range of 200 to 300. The most popular nickel-containing steels in this group are 2330, 3130, and 3135.

(2) Oil-hardened steels with 0.40-0.50 per cent carbon, which subdivide as follows:

(a) Those used in the fully hardened state, tempered to about 400 deg. Fahr. with resultant Brinell hardness of 550 to 600, with a tensile-strength range of 275,000 to 300,000 lb. per sq. in.

(b) Those treated to Brinelll hardness of 350 to 450, within a tensile-strength range of 175,000 to 225,000 lb. per sq. in., and

(c) Those treated to Brinell hardness values of 275 to 325 within a tensile-strength range of 140,000 to 170,000 lb. per sq. in.

The most popular nickel-containing steels in this group are 2340, 3140, 3145, 3150, 4340, *4345, 4640, and 4650.

(3) A specialty class of alloy steels with approximately 0.60 per cent carbon, used mainly for tools and dies. The nickel-containing steels of this group, including chromium-nickel, chromium - nickel - molybdenum - copper and chromium-nickel-molybdenum-vanadium steels, have properties which it will be most difficult to duplicate with other alloys without considerable research.

The principal uses of the 2300 series of thorough-hardening steels (3.25-3.75 per cent nickel) are in aircraft engine parts such as connecting rods, connecting-rod bolts, crankcase bolts, studs, keys, propeller shafts, generator shafts, pump shafts, rocker arms and gears.

Steels of the 3000 series (0.60-0.80 per cent nickel) are used chiefly in the manufacture of steering arms, steering-knuckle supports, and transmission gears.

Series 3100 steels (0.60-0.80 and 0.70-0.90 per cent nickel) are used mainly in aircraft-engine parts such as bolts, nuts, studs, connecting rods and crankshafts. In the automotive industry these steels are used for steering arms and knuckles, knuckle pins, crankshafts, differential drive pinions, pinion shafts, ring and side gears, propeller shafts, rear axles, transmission gears and transmission splined shafts.

Most of the 3300 series steel (3.25-3.75 per cent nickel) is used for heavy-duty shafting.

Principal uses of the 4000 series steels (no nickel) are in automotive bolts, pinion shafts, front and rear axles, leaf and coil springs, sway bars, cylinder-head studs, steering arms and steering knuckles.

The 4100 series steels (no nickel) are largely used in aircraft parts such as propeller blades, bolts, nuts, studs, connecting rods, crankshafts, cylinder liners and structural shapes and tubing. In the automotive industry they are used for steering arms and knuckles, connecting rods, crankshafts, transmission splined shafts, rear axles and trailer axles. Similar parts of marine engines also are made of these steels.

The principal uses of the 4300 series steels (1.65-2.00 per cent nickel) are in the manufacture of aircraft-engine parts such as crankshafts, propeller shafts, and connecting rods, and for automotive crankshafts and rear axles. It is also used for marine-engine crankshafts and propeller shafts and for different types of dies.

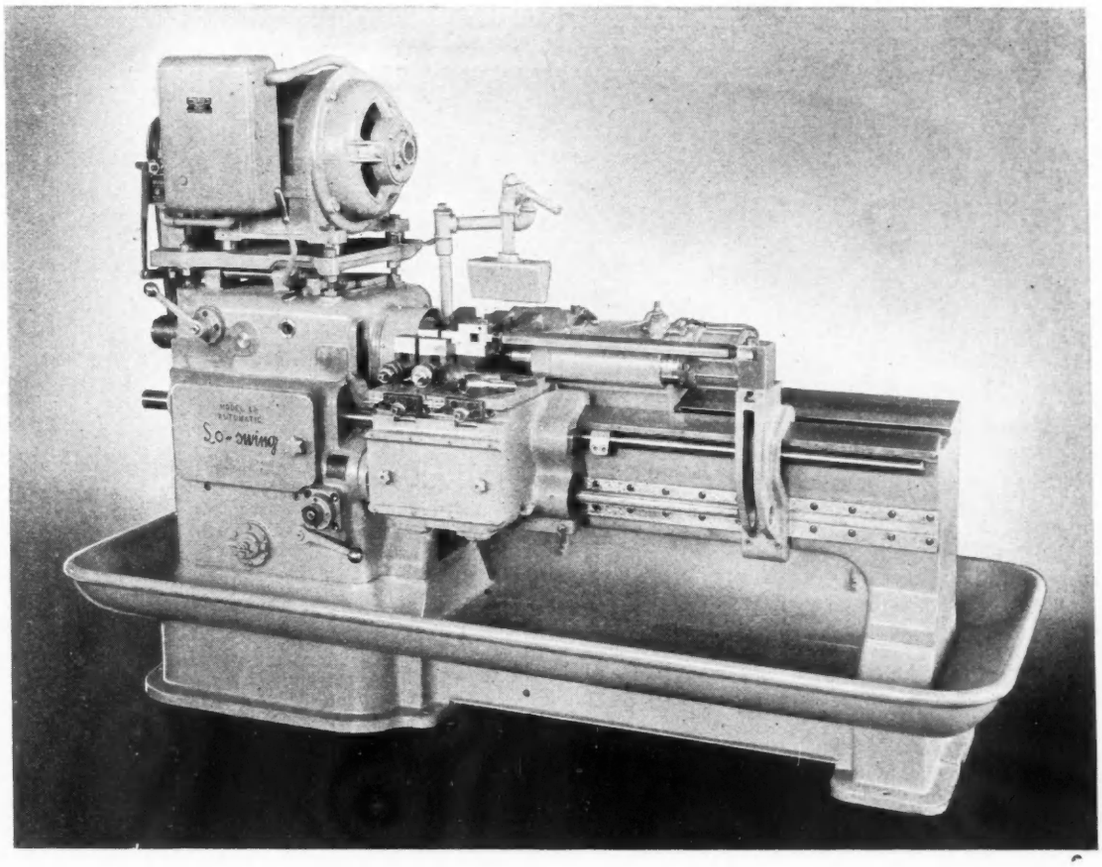
Steels of the 4600 series (1.65-2.00 per cent nickel) are used for forgings for aircraft engines, automotive trans-

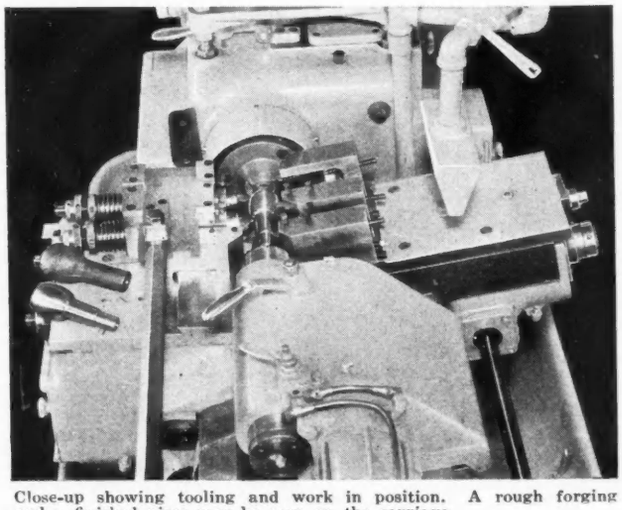
(*Turn to page 52, please*)

MACHINE OF THE MONTH

PREPARED BY THE SENECA FALLS MACHINE CO. "THE Lo-swing PEOPLE" SENECA FALLS, NEW YORK

MODEL LR Lo-swing LATHE COMPLETELY TURNS TORQUE ROD END PINS IN ONE OPERATION





Close-up showing tooling and work in position. A rough forging and a finished piece may be seen on the carriage.

● ***Problem:*** To completely turn, face, chamfer and square torque rod end pin forgings in one operation on a production basis.

Solution: A Model LR Automatic Lo-swing was selected for this job because it provided adequate speed, power and capacity.

The work comes to this machine in the form of rough forgings with a square hole in the ball end and with center holes drilled in a previous operation on a Seneca Falls Star Drilling and Centering Machine. Work is driven by means of a square driver, so designed as to clear the facing tool at that end. The opposite end of the piece has a protected center. In this way both ends can be completely faced.

The front carriage carries one plain and two template-controlled tool blocks. The two facing tools and one squaring tool are mounted on the back attachment. All tools are cemented carbide. Production is about 70 pieces per hour at 85% efficiency, and the work leaves this machine ready for grinding.

Nickel Steel Substitutes

(*Continued from page* 50)

mission gears, splined shafts, tractor gears, etc.

Steels of the 5000 series (no nickel) are used in clutch shafts and transmission main shafts.

The 5100 series (no nickel) goes largely into automotive leaf and coil springs, steering worms, transmission gears and transmission splined shafts.

Finally, steels of the 6100 series (no nickel) are used in the manufacture of such aircraft engine parts as propeller hubs and blades, coil springs, piston pins, knuckle pins, connecting rods, and crankshafts. They are used in the automotive industry for differential pinion and side gears, and leaf and coil springs.

In the foregoing only the aircraft, automotive and marine-engine uses of the various steels are mentioned. Quite naturally, many of these steels are used also for other industrial purposes, most of which are listed in the pamphlet under review.

In the case of the thorough-hardening steels, also, charts are given in which the chief physical properties of interchangeable steels are given in bar form. In the first chart, for instance, the two nickel-bearing steels 2330 and 3330 are compared with the nickel-free steels 4037 and 6130 with respect to tensile strength, yield point, reduction of area and Izod impact value. In addition there are graphs showing the variation of the various properties with the draw temperature, graphs showing the variation of the tensile strength with reduction of area, and graphs showing the variation of tensile strength with the Izod impact value. There are also graphs showing the variation of the Brinell hardness with distance from the center of the test specimen, the effect of mass on the tensile strength and Izod impact value, and the effect of the tempering temperature on the equivalent tensile strength and the Brinell hardness in the case of fully hardened steels with between 0.40 and 0.55 carbon, fully hardened steel with between 0.30 and 0.40 carbon, and not fully hardened steel.

Two of the physical property charts in the pamphlet of the American Iron and Steel Institute, one for case-hardening and the other for thorough-hardening steels, are reproduced herewith.

G.E. Flood Light Now Has Hinged Door

A hinged door which makes "relamping" and cleaning easier, has been added to General Electric's Type L-49 floodlight. This is a 300/500-watt incandescent general-purpose floodlight applicable for protective lighting systems, for use at gasoline stations, parking lots and factories. The reflector is available in either a polished (specular) or etched (diffused) surface. A mogul screw-base socket provides for fixed-focus mounting of a general-service incandescent lamp. A four-foot, two-conductor cable passes through a weatherproof stuffing gland. This cover glass is clear, convex, and heat-resisting.

An Improved Floodlight by G.E.

How the Gossip behind My Back... Cured Us of Assembly Delays

I OVERHEARD—
Other department heads were blaming inefficiency on my assembly line for delivery date delays. Naturally, I was worried.

I INVESTIGATED—
And found that the whispers were justified. Delays, low output, worker fatigue, *were* crippling our plant, particularly . . .

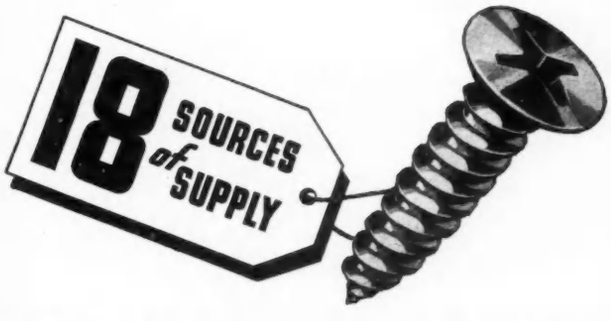
SCREW-DRIVING DELAYS!
Slow, awkward two-handed driving with slotted screws; scratched surfaces, fumbled screws — crookedly driven, split, burred, wasted!

OLD-FASHIONED FASTENING
A lot of small troubles added up to a *big* headache — all the result of buying a slow-driving slotted screw because it was *priced* less. Naturally we changed to Phillips Recessed Head Screws . . . and *now* . . .

PHILLIPS SCREWS CUT OUR ASSEMBLY TIME 50%!

- permitting fast power driving
- eliminating extra operations, pilot holes, washers
- freeing operator's hand to hold work
- increasing holding power (fewer screws needed)
- eliminating refinishing costs and time.

Slow-driving slotted screws may be holding up your assembly line right now. Hundreds of screw-using factories have obtained remarkable results by changing over to Phillips Screws. Write one of the firms listed below for facts about Phillips Screws in *your* industry.



PHILLIPS RECESSED HEAD SCREWS

Speed Product Deliveries by Cutting Assembly Time

WOOD SCREWS • MACHINE SCREWS • SHEET METAL SCREWS • STOVE BOLTS
SPECIAL THREAD-CUTTING SCREWS • SCREWS WITH LOCK WASHERS

U. S. Patents on Product and Methods Nos. 2,046,343; 2,046,837; 2,046,839; 2,046,840; 2,082,085; 2,084,078; 2,084,079; 2,090,338. Other Domestic and Foreign Patents Allowed and Pending.

American Screw Co., Providence, R.I.
Central Screw Co., Chicago, Ill.
Chandler Products Corp., Cleveland, Ohio
Continental Screw Co., New Bedford, Mass.
The Corbin Screw Corp., New Britain, Conn.
International Screw Co., Detroit, Mich.
The Lamson & Sessions Co., Cleveland, Ohio
The National Screw & Mfg. Co., Cleveland, Ohio
New England Screw Co., Keene, N.H.
The Charles Parker Co., Meriden, Conn.
Parker-Kalon Corp., New York, N.Y.
Pawtucket Screw Co., Pawtucket, R.I.
Pheoll Manufacturing Co., Chicago, Ill.
Russell, Burdsall & Ward Bolt & Nut Co., Port Chester, N.Y.
Scovill Manufacturing Co., Waterbury, Conn.
Shakeproof Lock Washer Co., Chicago, Ill.
The Southington Hardware Mfg. Co., Southington, Conn.
Whitney Screw Corp., Nashua, N.H.

MEN and MACHINES

(*Continued from page* 34)

A MACHINE for grinding chip-breaker grooves in carbide tools, with a 4-in. peripheral diamond wheel, powered by a ½-hp. motor and built around a new type universal-angle tool vise, has been placed on the market by Hammond Machinery Builders, Inc., Kalamazoo, Mich. The tool vise provides three separate planes of adjustment for the grinding angle. It consists of two steel blocks, rounded at the bottom, cradled into each other at right angles, and locked together after adjustment by means of cam locks operating in machined segments on their ends. Mounted atop these two blocks is a flat circular piece which swivels through 90 deg. from the center of any of the four sides of the block. This piece carries the vise jaws which hold the tools firmly by means of Allen screws. After the tool has been mounted in the vise, adjusted to the desired grinding angle, and locked, the entire unit is cranked into contact with the grinding wheel by means of a calibrated hand wheel.

The grinding assembly on the left side of the machine may be used for rough or finish grinding of carbide tools, using an 8-in. silicon-carbide or diamond wheel mounted on the spindle at the left side. Over the wheel is mounted an integral wheel guard and coolant tank with needle valve. A tilting work table, slotted for protractor angle-guide and fitted with an easily cleaned sludge pan underneath, is mounted on a 1¾-in. shaft extending from the left side of the base. To change wheels, the entire unit may be slid off the supporting shaft by loosening one clamp.

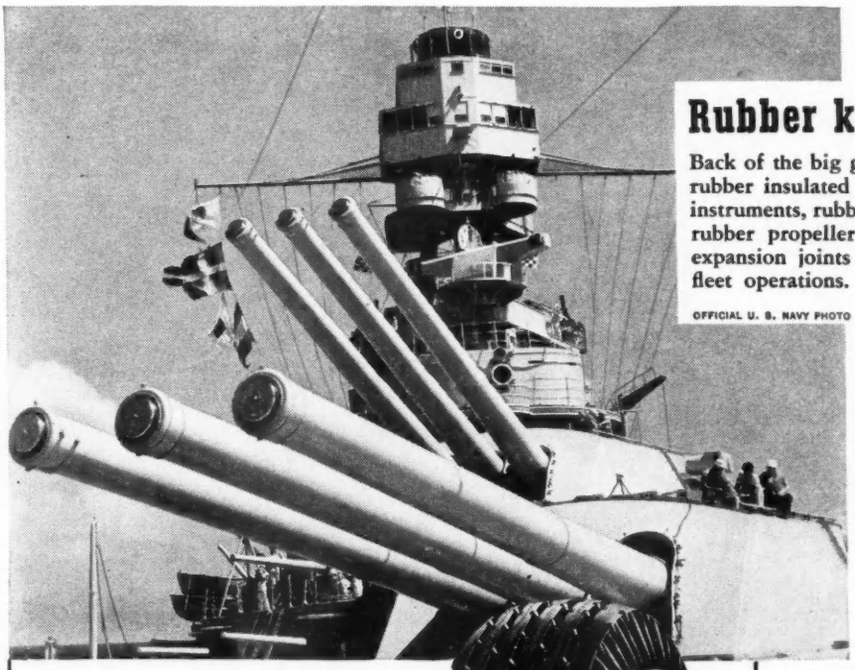
A NEW electric brazer for brazing and soldering with silver solder is announced by the Ideal Commutator Dresser Co., Sycamore, Ill. It operates on the same principle as "Thermo-Grip" soft-soldering tools, and consists of a power unit or transformer and a pair of electric-heating pliers. The over-all size is 14 by 12 by 25 in. and the weight, 100 lb. for the 60-cycle and 150 lb. for the 25-cycle unit.

TO meet demands for faster schedules, Black & Decker Manufacturing Co., Towson, Md., has developed a 9-in. heavy-duty production sander. It has a fast spindle lock which makes possible a quicker change of pads and abrasive disks. Power is furnished by the Black & Decker universal motor which operates on either DC or AC current, and the drive is through spiral bevel gears. Switch and commutator are sealed against abrasive dust and grit. The switch is of the plunger-operated type and cannot be turned on accidentally.

LEWIS-SHEPARD SALES CORP., Watertown, Mass., presents a new, quick-locking harness to speed up the handling and dumping of barrels and drums. It is no longer necessary to have the harness affixed to the drum or adjusted to it. A standard type of Lewis-Shepard barrel hoop truck deposits the drum directly into the harness. The harness is equipped with a spring toggle, is arc-welded throughout, and can be made for any size of drum.

A NEW 230-volt industrial multi-breaker announced by Cutler-Hammer, Inc., is claimed to afford economical application as a motor circuit switch or service disconnect switch. It is fuseless, with bi-metallic-strip actuation, visible trip indication, and trip-free lever. It is quick-make and quick-break, with a rated capacity of 230 volts from 15 to 100 amp., available in three-pole, three-pole solid neutral, or four-pole solid neutral types.

RUBBER *in Sea Defense*



Rubber keeps battle fleets afloat!

Back of the big guns is rubber . . . rubber hose, rubber gaskets, rubber insulated wires and cables, rubber cushions for delicate instruments, rubber life rafts, rubber deck cleats for safer footing, rubber propeller shaft linings, rubber gun mountings, rubber expansion joints and thousands of other rubber items vital to fleet operations.

OFFICIAL U. S. NAVY PHOTO

OFFICIAL U. S. NAVY PHOTO

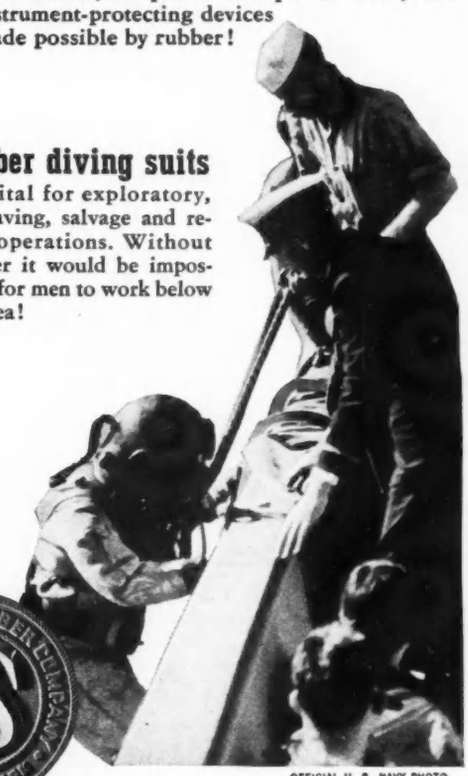
More rubber on the road with U. S. ROYAL DeLuxe

Wider, flatter tread of longer-wearing U. S. Tempered Rubber gives greater mileage . . . especially significant today when tires that last longer are so important to the government and to the motorist alike.

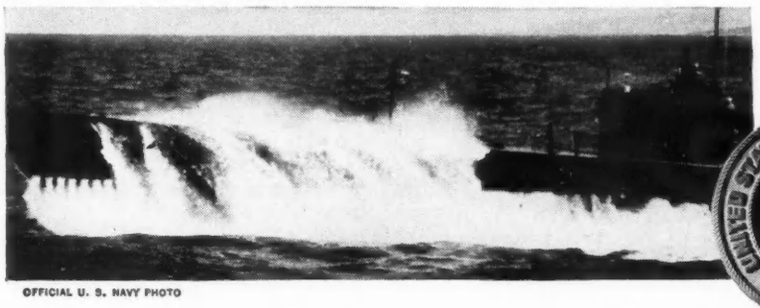
Rubber helps fire guns!... Modern gunnery would be unknown if it were not for control devices, telephone and power lines, and instrument-protecting devices made possible by rubber!

Rubber diving suits

are vital for exploratory, life-saving, salvage and repair operations. Without rubber it would be impossible for men to work below the sea!



No subs without rubber! Rubber hose and rubber gaskets are essential to a submarine's air and oil supply; rubber battery separators help provide undersea power, acidproof rubber linings protect battery room compartments, rubber mountings cushion guns.



OFFICIAL U. S. NAVY PHOTO

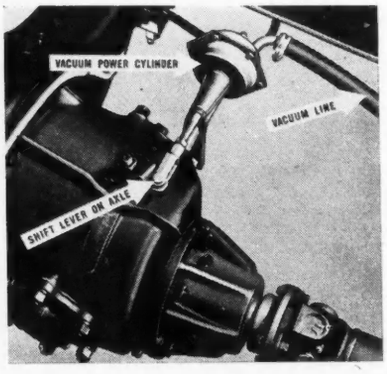
OFFICIAL U. S. NAVY PHOTO

UNITED STATES RUBBER COMPANY

6600 E. Jefferson Ave., Detroit, Mich.

Two Improvements for Timken Two-Speed Axles

Although the manual shifting of Timken two-speed axles by means of a lever in the truck cab is considered not difficult, engineers of the Timken-Detroit Axle Co. have improved the shifting still further by developing a new design for spline teeth that allows an instantaneous engagement of the shift collar with the desired spur pinion at synchronized speeds. It has been named the Timken "Easy-Shift." With the newly designed spline teeth, gear shifts can be made without declutching in most instances after a little practice.



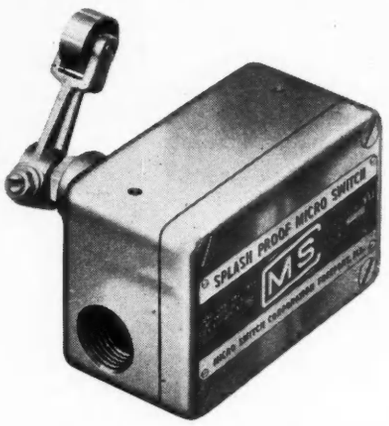
Power Shift on Timken Axle

The Timken "Easy-Shift" has been hooked up with power shifting in several ways by vehicle builders. Where vacuum power is used, a vacuum cylinder shifts in one direction by the use of vacuum and in the return direction by means of a spring. This power unit is mounted directly on the differential carrier. A control button, or cable knob, is provided in a convenient location, either on the steering column or instrument panel, and operates the vacuum valve. An installation of this type is shown in the accompanying illustration.

This power actuation provides a silent and effortless shift with lightning speed from one gear ratio to the other. It results in the elimination of speed loss in shifting on upgrades, elimination of shock loads from sudden clutch engagement and also eliminates the extra control lever in the cab.

Micro Switch Corp. Makes Splash Proof Unit

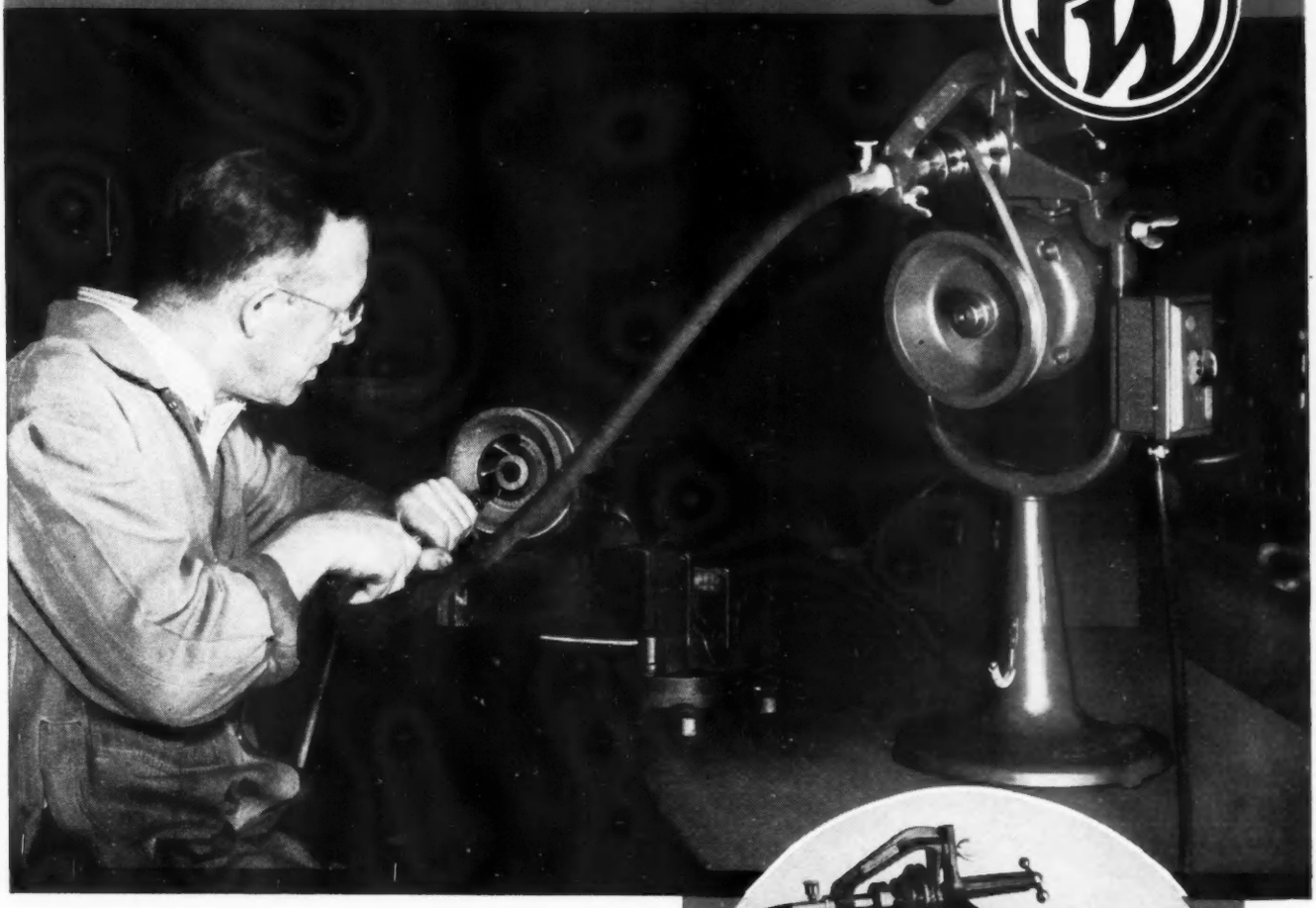
A splash proof, malleable-housed precision switch, which can be conveniently mounted from any one of four sides for use as an interlock, limit or pushbutton switch, is announced by the Micro Switch Corp., Freeport, Ill. The variety of mounting positions is an exceptionally useful feature of the switch. It is possible to mount the switch directly to a machine frame from practically any position whether the switch has the roller arm, cross-roller arm, or push-rod plunger type of actuation. If lug or foot mounting is desired, 3/16-in. thick steel mounting plates can be furnished.

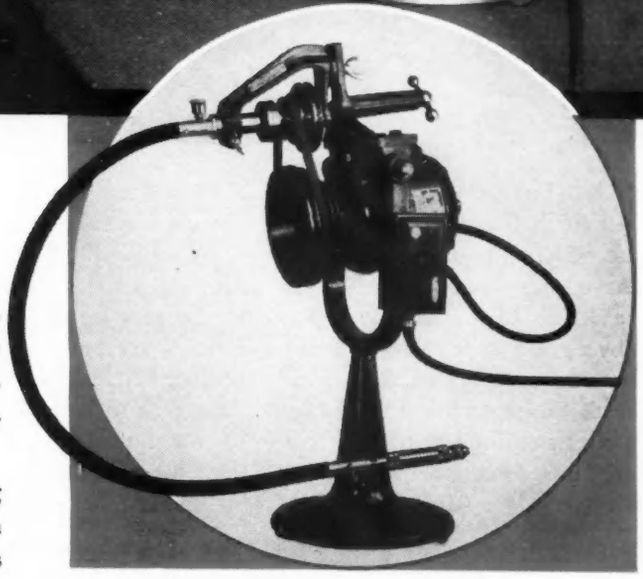


The switching element is a Bakelite Micro Switch which is rated at 1200 watts up to 600 volts a.c.

Both types of roller arm are of aluminum, adjustable through 360 deg. with the roller of a non-sparking material of high concentricity. The roller rides on an oilless-bronze bearing. Overtravel on this switch is 90 deg. The plunger type of actuator has a bullet-nose push-rod of case hardened steel which moves in a long cadmium plated hexagonal bushing.

Are you getting all your KELLERFLEX can give?





The Kellerflex JB-1 machine, shown here, has a ¼ H.P. totally enclosed motor with an overload switch. Speeds available for this model range from 875 to 6800 R.P.M.

RIGID quality has reaped its reward . . . defense industries have found that they can depend on the trouble-free operation of Kellerflex machines and equipment. Their power and flexibility can be used constantly . . . 24 hours a day—every day.

Check the grinding, burring, sanding and polishing jobs in your own plant and remember . . . you can push your Kellerflex equipment to the limit—it was designed for the long, tough jobs as well as intricate precision work.

Headquarters for the finest flexible shaft equipment.

PRATT & WHITNEY Division Niles-Bement-Pond Co. West Hartford, Conn.

Kellerflex Sales Department

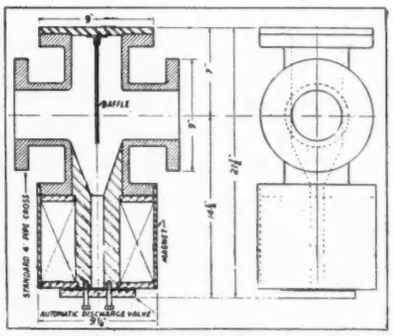
High Nickel Spring Is Self-Compensating

A new self-compensating spring now available commercially utilizes a 36 per cent nickel steel and can be combined with other springs or elastic elements such as bellows, diaphragms, etc., to produce instruments, the accuracy of which is said to be virtually unaffected by ordinary temperature changes.

These springs, manufactured by All-Weather Springs, New York City, are now being used in spring scales, aeronautical instruments and other spring actuated instruments, which may be used in localities where they are exposed to wide temperature variation.

Dings Magnetic Separator

The accompanying drawing illustrates a new type of magnetic separator, which originally was designed for a concern engaged in reaming rifle barrels, to remove small particles of iron from circulating cutting compounds. It consists of a baffle installed in the pie cross, as indicated, which deflects the flow of liquid to the poles of a high-intensity electro magnet. A considerable portion of iron can be allowed to accumulate on the magnet poles before cleaning is necessary. Cleaning is accomplished by interrupting the current to the magnet, which then becomes de-energized and releases the accumulated iron and also the automatic discharge valve. This permits a flushing action through the bottom of the magnet which thoroughly cleans it. When current is turned on, the discharge valve closes securely.

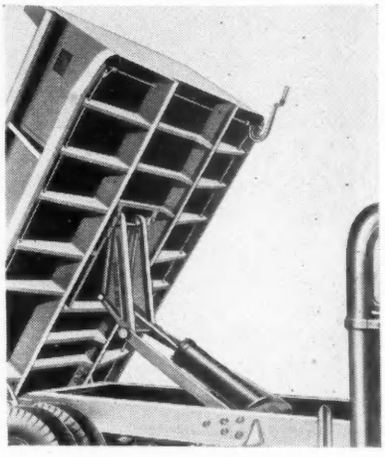


Removes Iron Particles from Flowing Cutting Compounds

This magnet is supplied with a suitable rectifier for supplying dc current. The machine is the product of Dings Magnetic Separator Co., Milwaukee.

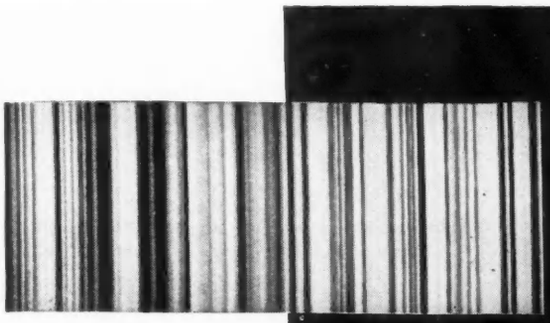
Gar Wood Arm-Type Hoists

Gar Wood Industries, Inc., Detroit, is now in production on several new arm-type hydraulic hoist models which are recommended for installation on



For 8 to 10 ft. Dump Bodies

1½ to 2-ton truck chassis and specially adaptable for use in connection with dump bodies of from 8 to 10 ft. length. These hoists, which are being manufactured in three sizes, involve a new lifting arrangement which distributes the lifting effort over a greater area. Other advantages claimed are that stresses on body, hinges and chassis frame are minimized, that the lever arm is longer, that parts are fewer, that operation is fast, that minimum oil pressure is used, and that the weight is a minimum for an arm-type hoist.



Enlarged spectrogram of a nickel-chromium-molybdenum steel.

Alloy Steels

Research in Action...

Quality in alloy steels is largely a matter of precise control of composition during the steel-making process. But to control composition, to know what additions to make to each heat, the steel-maker must have some rapid means of determining the exact percentage of each element present. For such purposes, chemical analysis is far too slow, the analyses for certain elements serving only as "post-mortem" reports on the finished steel. This is all right as far as *checking* quality goes, but gives no basis for *controlling* it.

In Bethlehem's modern plants, Physical Chemistry's most recently developed method of rapid quantitative analysis is in routine use on a 24-hour-a-day basis. In this method, a spectrographic negative is made, using samples of metal from a given heat. The blackness of the line on the film caused by each element present is measured photoelectrically, and the measurements are converted directly into percentages. Accurate analysis is available ten minutes after samples leave the furnace.

In this example of Bethlehem's integration of research and production is another reason why you can rely on Bethlehem Alloy Steels—today and tomorrow. For out of such research on a production scale come not only today's quality steels but tomorrow's major alloy steel developments as well. Bethlehem Alloy Steels include every steel in the S.A.E. series, as well as to other specifications, and are available as bars and billets in all conditions of treatment and finish.

BETHLEHEM STEEL COMPANY

BETHLEHEM STEEL

BOOKS . . .

THE HIGH-SPEED INTERNAL COMBUSTION ENGINE, *by Harry R. Ricardo. Third edition, revised by H. S. Glyde. Published by Blackie & Son, Ltd., London and Glasgow (Inter-science Publishers, Inc., New York).*

In a preface to this third edition of the second volume of his The Internal Combustion Engine, Mr. Ricardo explains that owing to the European war and the strenuous months immediately preceding it, he did not have the time to undertake the work of revision himself, and therefore entrusted it to one of his assistants, H. S. Glyde, who has worked with him during the past 17 years. The book has always leaned more toward fundamentals than toward features of current practice, which undoubtedly lessened the need for extensive revision. Mr. Glyde in a Foreword states that he endeavored to retain as much of the original text as possible, but to eliminate material which had lost timely interest. However, the chapter on High-Speed Diesel Engines, which concludes the volume, was entirely rewritten. That this should have been necessary can be readily understood, since the last previous edition appeared in 1931, at which time the high-speed Diesel was still in its infancy.

A relatively large amount of space is devoted to the subjects of fuels and combustion phenomena, in which fields the author has done outstanding research work. In a chapter entitled, "Distribution of Heat in a High-Speed Four-Cycle Engine," the temperature and pressures at the beginning and end of each of the four strokes are calculated for the case of a gasoline engine of 80 cu. in. cylinder displacement, operating with a compression ratio of 5, under full throttle, at 2000 r.p.m.

One chapter is devoted to Lubrication and Bearing Wear; then there are four chapters on details of design, one of these dealing with Valves and Valve Gear and another with Piston Design. The last three chapters are devoted to specific types of engines, viz., Engines for Road Vehicles; High-Speed, Heavy-Duty Engines for Tanks, and High-Speed Diesel Engines.

The authoritative character of this book has long been established and it needs no further recommendation.

THE AUTOMOBILE INDUSTRY—THE COMING OF AGE OF CAPITALISM'S FAVORITE CHILD. *By E. D. Kennedy. Published by Reynal & Hitchcock, New York.*

This is a very readable and well documented work dealing with the history of the automobile industry chiefly from the sales and financial aspects. It traces the histories of the various large firms in the industry and comments interestingly on individuals and events which shaped them. Not quite up to the standard of accuracy of the work as a whole is the first chapter—*The Horseless Carriage*, 1890-1900. Here the author seems to have relied for his information to a considerable extent upon the recollections of one individual who played a part in the early development. It is rather surprising that so little is said regarding the steam car. The Locomobile steamer, developed by the Stanley brothers, was really America's first quantity-produced car, as it was made by the thousands during the period 1900-1902. The Oldsmobile which the author credits with having been the first, succeeded and really drove out the light steamer. These criticisms are restricted to the first chapter dealing with the beginnings of the automobile industry in this country.

PROCEEDINGS OF THE TWENTIETH ANNUAL MEETING OF THE HIGHWAY RESEARCH BOARD, *edited by Roy W. Crum, Director. Published by the Division of Engineering and Industrial Research of the National Research Council, Washington, D. C.*

While most of the papers presented at this meeting deal with technical problems of highway design, construction and maintenance, some of them are of direct interest to the automobile industry. Among these is a paper on the Problem of Parking Facilities by Thomas H. McDonald, Commissioner of Public Roads Administration. Various suggestions are made in this paper with the object of relieving congestion in city streets and reducing costs to motor vehicle owners. It is suggested that municipal governments might encourage private operators of parking lots by eliminating license fees on such lots, by lowering assessments on land used for parking, or by the abatement of taxes on such property. Cities also might assist private enterprise by furnishing adequate street approaches, by enforcing street-parking restrictions, by leasing public lands to private operators, and by planning the most desirable locations and designs for future parking facilities. The success and growth of public parking accommodations suggest further development of public ownership and operation, and the passage of the necessary legislation. State governments might contribute to a solution by permitting the use of revenue bonds for parking facilities and the servicing of these with shares of state motor-vehicle revenues at present being made available for municipal streets. The Federal Government might assist in furnishing land by RFC loans or the demolition of condemned buildings through WPA, and by sponsor-

(*Turn to page 62, please*)

Look over her shoulder—

This little lady next to the window, like her mother, is a passenger in one of your cars. She trusts that car to get her to her destination enjoyably and safely.

Clear, spacious windows of Libbey·Owens·Ford Hi-Test Safety Plate Glass help accomplish that mission. This laminated glass . . . two lights of polished plate glass bonded together by a strong, tough, transparent plastic . . . makes her journey safer. Its clear vision adds to her enjoyment of it.

L·O·F Hi-Test Safety Plate, the glass with the good looks, is helping sell new cars. Its use for side windows as well as windshields by many 1941 cars is proof of the industry's high regard for this clearer vision glass.

Look at what you look through

HI-TEST L·O·F SAFETY PLATE AS 11-40

LIBBEY · OWENS · FORD

HI-TEST SAFETY PLATE GLASS

BOOKS

(Continued from page 60)

ing adequate surveys and planning of parking needs.

In a paper on Safe Speeds on Curves R. A. Moyer and D. S. Berry state that so far 25 states have adopted the plan of marking road curves with the maximum safe speeds. The ball bank indicator is used to determine the maximum safe speed which is taken to be that giving a ball bank angle of 10 deg.

Effects of highway lighting on driver behavior are discussed in a paper by W. P. Walker. Interesting information on deceleration distances for high-speed vehicles is contained in a paper by Ernest E. Wilson, director of the General Motors proving Ground.

MEN . . . . . .

J. W. Colgan, formerly manager of Handy & Harman of Canada Ltd., Toronto, has been made sales manager of the parent company in New York City.

Charles E. Sorenson and **A. M. Wibel** have been elected vice-presidents and directors of the Ford Motor Co. P. E. Martin has resigned as vice-president to take a year's leave of absence to recuperate from a recent illness.

Philip N. Cooke, sales manager of Norton Co. of Canada Ltd., Ontario, has been appointed resident manager, succeeding Robert C. Douglas, who died may 29. **D. M. Chisholm** of the Canadian sales organization succeeds Mr. Cooke as sales manager.

W. A. Fletcher has been named district sales manager for the Western Division of E. F. Houghton & Co.; he was recently head of their Government Products Div.

Worthington Pump and Machinery Corp. has appointed **Carleton Reynell** as general manager of purchases and traffic, **Frederic W. Thomas** as assistant general manager of purchases, and **Dean K. Chadbourne** as assistant general manager of traffic.

Harry D. Kellog, Link-Belt, Chicago, treasurer and assistant secretary, has been elected secretary, retaining his post as treasurer, to succeed **F. V. MacArthur,** retired after 50 years with the company. **Melbourne P. Anderson,** general accountant, has been appointed assistant treasurer. **Henry C. Oakes,** statistician, has been made assistant secretary. **Frank H. Brandt,** accountant at the company's Pershing Road Chicago Works, has been appointed general auditor.

J. Griffith Boardman, president of J. G. Boardman & Co., Philadelphia, has been elected a director of Brewster Aeronautical Corp.

Edmund R. Walker has been promoted to assistant general manager of Fedders Mfg. Co. He formerly was manager of the air conditioning division.

Thomas O. Warfield has been appointed eastern sales manager of United Motors Service; this position was formerly held by **L. W. Martin,** who recently was made general sales manager.

M. J. Tennes, Jr., president of Shafer Bearing Corp., has entered active service as captain in the U. S. Army Air Force. During the absence of Captain Tennes, the management of the Shafer Bearing Corp. will be under the direction of **John F. Ditzell,** vice-president and general manager.

Bliss & Laughlin, Inc., announces the appointment of **J. Earl Romer** as district manager of the Cleveland office, succeeding **A. W. Schultz,** resigned.

Thomas F. Troxell has been elected treasurer and director of Copperweld Steel Co.

Sidney D. Williams, formerly vice-president in charge of steel sales, has been made executive vice-president in charge of the Warren, Ohio, division. **William B. Klee, Jr.,** assistant secretary, has also been made assistant to the executive vice-president.

Edwin Fisher has resigned from the Cadillac Motor Car Co. to join Progressive Welder Co., where he will assist in the development of sales in the middle Western area.

Carl F. Lozon, former general superintendent of Chrysler's Jefferson Ave. Division in Detroit, has been appointed chief of a new Bell Aircraft Corp. ordnance division, Buffalo, which has contracts for manufacturing machine gun adapters and mounts. During the World War I, Mr. Lozon was superintendent of the Buick plant making Liberty airplane engines.

Thomas J. O'Rourke, former vice-president of the Pierce-Arrow Motor Car Co. in charge of sales, has been appointed manager of the Buffalo OPM office. Mr. O'Rourke was associated with Pierce-Arrow for 30 years.

Henry L. Clark has been named general manager of the Southern California Division of General Motors, succeeding **Raymond J. Wilkins,** who will become a member of the labor relations staff in Detroit.

Russell G. Davis has been appointed manager of the Chicago Commercial Gear Plant of Foote Bros. Gear & Machine Corp.

Daniel M. Watts, former assistant general manager of Bendix Aviation Corp., has been named factory manager of the Kaydon Engineering Corp., Muskegon, Mich.

Archie A. Morris is the new Southern California representative for McKenna Metals Co., Latrobe, Pa.

K. D. Smith, for the past nine years technical superintendent of the tire division of B. F. Goodrich Co., Akron, has been named assistant to T. G. Graham, vice-president in charge of factory operations.

Two Advantages

IN THIS 2000-TON TURRET PRESS

FASTER and more accurate forming of sheet metal parts is possible with this Birdsboro press because of its Two-Stage pressing speed and its Non-Jar turret indexing.

With the Two-Stage pressing speed, the ram performs most of the draw at high speed and then does the final or ironing operation at slower speed and maximum pressure. Thus maximum efficiency and production is obtained from the smallest possible power unit.

The Non-Jar turret indexing provides smooth acceleration and deceleration of the rotating table, eliminating jar-caused shifting of the work on the dies. As a result, rejected work is reduced to a minimum.

Like so many Birdsboro presses, this press was built to meet the demands of National Defense. When the emergency is over, it will be equally suited to economical production of domestic products.

BIRDSBORO STEEL FOUNDRY AND MACHINE COMPANY

Plants at Birdsboro and Reading, Pa.

BIRDSBORO

Hydraulic Presses

BUILDERS OF: HYDRAULIC PRESSES . ROLLS . MILL EQUIPMENT . SPECIAL MACHINERY . CRUSHING MACHINERY

New Magnesium Foundry

A new company, known as Light Metals, Inc., has established a Magnesium alloy foundry at Indianapolis. The company is a licensee of the Dow Metal Co. and will produce castings in accordance with A.S.T.M., Navy and Army specifications.

N.I.A.A. to Toronto

The 19th annual conference of the National Industrial Advertisers Association, Inc., will go to Canada for the first time this year and will be held at the Royal York Hotel, Toronto, Sept. 17 to 19. A special feature will be the inclusion of a large exhibit of machine guns, bombs, anti-aircraft and anti-tank guns and other products of the Canadian war effort.

Fred Fisher Dies; Was Co-Founder of Body Co.

Fred J. Fisher, oldest of the seven Fisher brothers and co-founder of the Fisher Body Corp., died in the Henry Ford Hospital, Detroit, on July 14. Mr. Fisher had been in the hospital for several weeks following a heart attack. At his bedside when death came were Mrs. Fisher and all six of his brothers.

As a boy Mr. Fisher worked in his father's blacksmith and carriage shop in Norwalk, Ohio. Each year he spent several months in Detroit and at 24 he obtained a job with the Wilson Carriage Works in that city. In 1907 he became its general manager and one year later he and his brothers founded the Fisher Body Co. After the first year, the new company obtained an order for 150 bodies from Cadillac Motor Co. and from that time on the company never lost its position of leadership in the industry.

Allegheny Ludlum Expands High Alloy Steel Output

With one new 35-ton electric melting furnace already in operation and another due to arrive soon, the Brackenridge, Pa., plant of the Allegheny Ludlum Steel Corp., Pittsburgh, is preparing to contribute to the needed increase in the nation's productive capacity of special, or "high-alloy" steels. The two large furnaces are to be housed in a new mill building now rising rapidly at one end of the main plant.

The increased melting capacity at Brackenridge is a part of Allegheny Ludlum's $4,650,000 general expansion program, and in itself will increase the company's production of special steels by approximately 50,000 tons annually. Expansion of other production facilities have already lifted the company's current output to a rate four times that of only two years ago.

Schostal

Black-Out Light

Every German car is said to carry this new type black-out lamp which gives a unified beam approximately 40 meters long. Light is reflected by a specially constructed mirror which breaks the light into numerous parts. The hood completely shields the beam from the air.

AMA Issues Study on Automobile Use

Necessity use of private passenger cars accounts for 274 billion passenger-miles a year compared with only 26.8 billion passenger-miles on electric railways, 23.7 billion on steam railways and 21 billion on buses. This was one of many interesting estimates compiled by the Automobile Manufactures Association and incorporated in a booklet, "A Factual Survey of Automobile Usage."

In cities up to 500,000 population as many as 70 per cent of the people entering the business section do so in private automobiles, the survey also showed, and it was discovered that 2100 American communities with populations over 2500 had no mass transportation system whatsoever. Their combined population is nearly 12,000,000 people.

Much of the material gathered has been used by the AMA in a report to the House Ways and Means Committee to show the adverse effect of proposed increases in automobile taxation, particularly with regard to the defense worker whose new occupation often necessitates longer drives to work.

Rubber Consumption Increases During June

Rubber consumption continued its record breaking pace in this country during June when 84,912 long tons were used, or 19 per cent above May and 77.5 per cent over June, 1940.

Gross imports for June totaled 65,093 long tons, according to the Department of Commerce. This represents a decrease of 35.8 per cent below May, but is 20.8 per cent over June, 1940. Total domestic stocks at the end of June, including Government reserves, totaled 339,108 long tons. This is 5.6 per cent below May, but is more than double the stocks estimated for June 30, 1940.

Stocks in the hands of the U. S. Government June 30, were 206,003 long tons, an increase of 10.3 per cent over May of this year. Stocks afloat for United States ports on June 30 were the highest yet reported, 175,499 long tons.

Reclaimed rubber consumption during June totaled 22,559 long tons; production, 23,790 long tons; and stocks on hand June 30—36,265 long tons.

Hudson First to Display 1942 Models

Hudson was the first manufacturer to display its 1942 models, doing so at a meeting of distributors in Detroit late in July. While presenting the new models, A. E. Barit, Hudson president, called attention to the company's $70,000,000 defense order and said that although automobile production will be restricted, traditional high standards would be maintained.

The new cars feature minor mechanical refinements, longer and lower bodies, new front end styling and new upholstery fabrics.

James McNair Buick

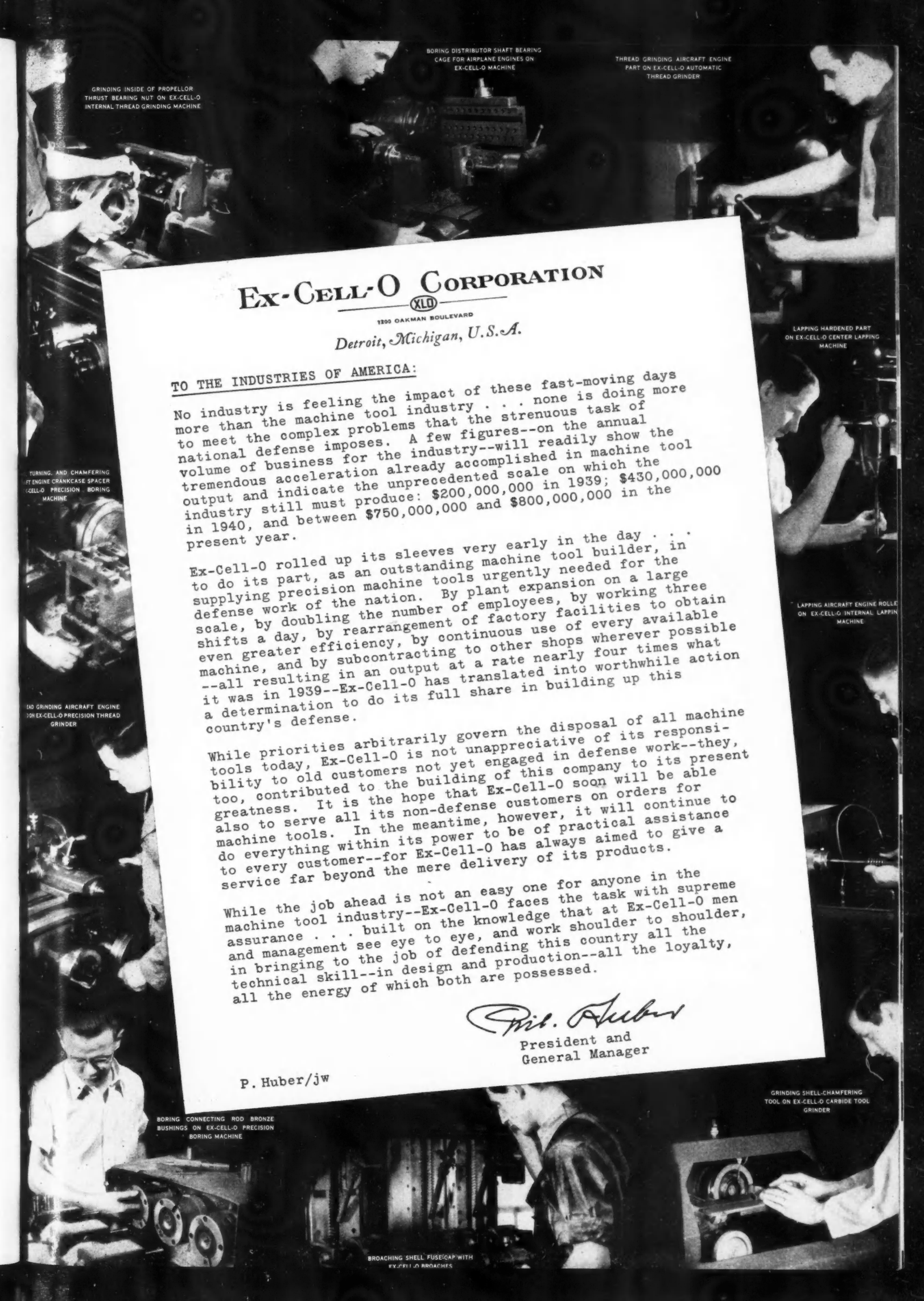
James McNair Buick, vice-president and director of the American Car and Foundry Co., until his retirement in 1925, died July 26 in New York City. Mr. Buick was a cousin of the late David D. Buick, founder of the Buick Motor Corp.

Goodyear Plant in Arizona

A Goodyear subsidiary shortly will erect a large plant for the manufacture of airplane parts at Litchfield Park, Ariz., 15 miles west of Phoenix. The investment is expected to be upwards of $500,000, exclusive of equipment.

Vascoloy-Ramet Office

Vascoloy-Ramet Corp., North Chicago, Ill., has opened a district sales engineering office at 50 Church Street, New York. Eugene Roth is in charge, assisted by Alvan Carver, Harry J. Chase and Standish Rowe. The company's Eastern sales were formerly handled from its Jersey City plant.



EX-CELL-O CORPORATION

(XLO)

1200 OAKMAN BOULEVARD

Detroit, Michigan, U.S.A.

TO THE INDUSTRIES OF AMERICA:

No industry is feeling the impact of these fast-moving days more than the machine tool industry . . . none is doing more to meet the complex problems that the strenuous task of national defense imposes. A few figures--on the annual volume of business for the industry--will readily show the tremendous acceleration already accomplished in machine tool output and indicate the unprecedented scale on which the industry still must produce: $200,000,000 in 1939; $430,000,000 in 1940, and between $750,000,000 and $800,000,000 in the present year.

Ex-Cell-O rolled up its sleeves very early in the day . . . to do its part, as an outstanding machine tool builder, in supplying precision machine tools urgently needed for the defense work of the nation. By plant expansion on a large scale, by doubling the number of employees, by working three shifts a day, by rearrangement of factory facilities to obtain even greater efficiency, by continuous use of every available machine, and by subcontracting to other shops wherever possible --all resulting in an output at a rate nearly four times what it was in 1939--Ex-Cell-O has translated into worthwhile action a determination to do its full share in building up this country's defense.

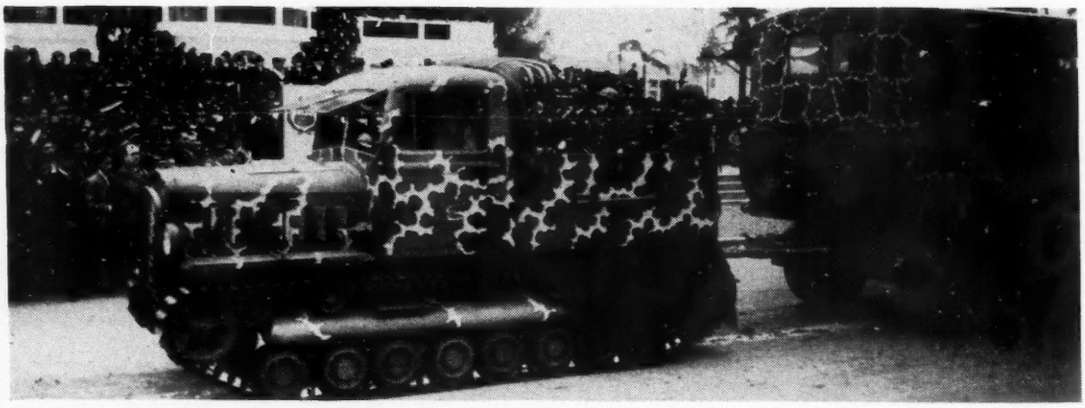
While priorities arbitrarily govern the disposal of all machine tools today, Ex-Cell-O is not unappreciative of its responsibility to old customers not yet engaged in defense work--they, too, contributed to the building of this company to its present greatness. It is the hope that Ex-Cell-O soon will be able also to serve all its non-defense customers on orders for machine tools. In the meantime, however, it will continue to do everything within its power to be of practical assistance to every customer--for Ex-Cell-O has always aimed to give a service far beyond the mere delivery of its products.

While the job ahead is not an easy one for anyone in the machine tool industry--Ex-Cell-O faces the task with supreme assurance . . . built on the knowledge that at Ex-Cell-O men and management see eye to eye, and work shoulder to shoulder, in bringing to the job of defending this country all the technical skill--in design and production--all the loyalty, all the energy of which both are possessed.

P. Huber

President and
General Manager

P. Huber/jw



Schostal

Peru on the Move

Just before Peru and Ecuador began arguing the source of the first shot in recent border disputes, the Peruvian army staged a special review for the president. Among other equipment on parade was this modern tractor.

Change-Over

(*Continued from page 44*)

tion in one of the Detroit district plants for a few days recently.

Announcement by the Office of Production Management that it had approved an increase in pig iron capacity by 6,508,950 tons and was "exploring" the possibility of increasing steel ingot capacity by 15,000,000 tons a year was interpreted in the steel market as indicating definite acceptance by the defense authorities of a program of capacity expansion, which some steel producers declare is unnecessary. At the same time OPM looked into the alloy and tool steel situation, characterizing the supply of both as tight.

The full effect of OPM's policy of withholding from consumers with heavy stockpiles additional supplies until reserves have been brought down, will be some time in making itself felt, but eventually more even distribution and lessened pressure on producers are expected to result, especially so in the case of pig iron, which lends itself readily to stocking.

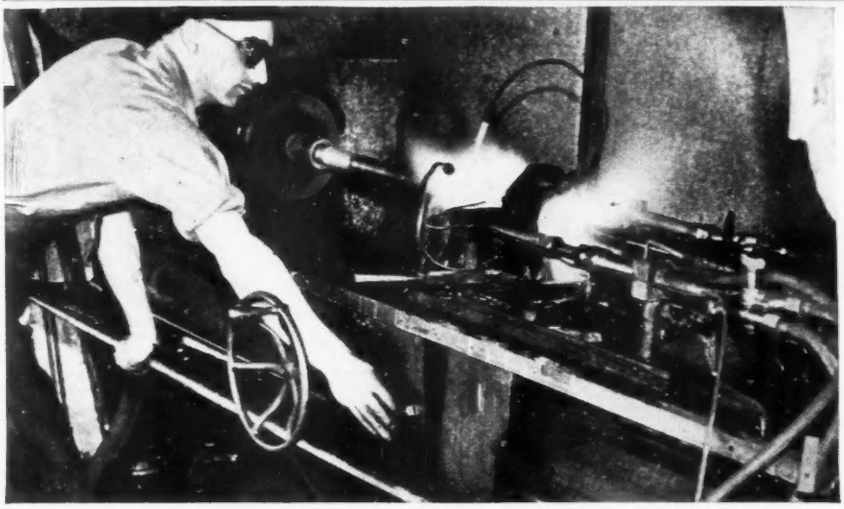
Trading in copper futures on the New York Commodity Exchange has been suspended. Some 500,000 tons of Chilean copper are reported to be awaiting shipment to the United States. Unless more cargo vessels for the transportation of copper from South America are made available soon, a serious shortage in the supply is feared. Announcement of ceiling prices for brass mill scrap by Leon Henderson, O.P.A.C.S. Administrator, marks further extension of Government control of the copper market, which had been expecting regulations for the distribution of both domestic and foreign metal before this.

Renewed tension in the Far East as the result of Japan's designs on French Indo-China, caused much uneasiness in the tin market. Prices had been moving lower, but political and naval developments changed this tendency. Recent arrivals of Straits tin had been reassuring.

Announcement of plans for augmenting the output of magnesium was received with considerable interest in the trade.

Out Went.. EXPENSIVE INNER RACES

when AIRCO FLAME HARDENING came in



Flame hardening the shaft. Only the ends require hardening to resist wear on the bearing spots.

Workman examining hardened shafts which are now ready for assembly.

This manufacturer's problem was to increase the service life of a shaft without raising the cost of manufacture. Originally, a softer shaft was used. It was heat treated, then ground to fit inner races which were inserted at each end for bearings. "Now," he says, "thanks to Airco Flame Hardening separate inner races are unnecessary. No longer are expensive heat treating and grinding operations needed. The wearing qualities of the product are vastly improved—yet it costs less to build."

Numerous other hardening applications are helping America build better defense products faster. Representatives of the Airco Applied Engineering Department will be glad to assist you in the proper application of flame hardening to your individual problem.

Air Reduction

General Offices: 60 EAST 42nd ST., NEW YORK, N. Y.

DISTRICT OFFICES IN PRINCIPAL CITIES

AIRCO — WILSON

Anything and Everything for **GAS WELDING or CUTTING and ARC WELDING**

OPM Issues Ruling on Cutting Tools

A general preference restriction to prevent manufacturers and distributors from accepting an order for cutting tools, which does not bear a preference rating of A-10 or higher, has been issued by the OPM priorities division. However, it is not effective if all defense orders on hand have been met.

The preference order, whose issuance was prompted by an increasing shortage of cutting tools, defines cutting tools as including: Special drills of all types, oil tube and oil hole drills of all types and sizes, special reamers, countersinks, counterbores, special milling cutters, of all sizes and types, hobs of all sizes and types, high speed taps, special taps, high speed chasers for self-opening die heads, high speed chasers for collapsing taps, and machine broaches.

GM's Quarterly Report

General Motors quarterly income statement reports a net income after provision for all taxes of $53,579,568 for the three months ended June 30. This compares with a net profit of $46,546,999 in the same period a year ago. Total sales to dealers including overseas shipments amounted to 732,314 cars and trucks or an increase of 33.2 per cent over the 549,605 sold during the second quarter of 1940.

During the quarter just completed there was an average of 318,726 employes on the corporation's books compared with 245,338 during the same period of 1940. This was an increase of 29.9 per cent.

Improved Fuel System Eliminates Vapor Lock

An aircraft engine fuel system which is said to eliminate the danger of vapor lock caused by the boiling of gasoline has been designed by the National Bureau of Standards. Tests by the services and the industry pointed to the pump in the fuel system as the most likely cause of gasoline boiling. It was found that by placing a second pump in a position where it could move the fuel with the least suction, the hazard was measurably reduced. By measuring the resistance to flow of each valve and fitting, experts found that they could come close to determining the rate of flow for the system as a whole, which enabled them to make improvements. The Bureau said that while the vapor lock problem had not been entirely solved, more dependable operation would result from the recommended changes.

August W. Sidell

August W. Sidell, retired demonstrator for Gisholt Machine Co., Madison, Wis., died June 30 at the age of 76. He was one of the company's oldest representatives having joined the organization prior to 1904.

40 YEARS AGO

A Military Transport Wagon

The Austrian Military Technical Committee has, we learn, ordered a specially designed military transport wagon of the Austrian Daimler Motor Company, of Vienna. It is to have a 10 horse power motor, though the load the wagon will be expected to carry will not exceed that usually drawn by a 6 horse power motor. Special attention has been paid to obtaining a low regular rate of speed, so that the wagon shall be capable of moving with the troops when progress is slow and not have to stop for the troops to catch up. It will have four rates of speed, and the lowest of these will be rather under one mile an hour. It will carry benzine sufficient for a twelve hours' run. The width of its track will be the same as that of a field gun, about 5 feet. The motor will be adapted for use as a stationary engine, and will be used, among other purposes, in the working of dynamos for the generating of electricity for searchlights.

From *The Horseless Age*, August 21, 1901

SAFETY IN THE AIR

WITH STEEL CASTINGS

WHERE *LIFE* DEPENDS ON *STRENGTH*...

Here is the world's safest airplane, the Autogiro. Its unique "rotor" permits it to land "on a dime," or take off with a vertical jump. And all at almost walking speed. There is no other plane like it.

The supporting members for the horizontal lifting rotor are made of alloy cast steel.

There is a sound reason for this choice. Alloy steel castings provide the ideal combination of great strength without extra weight, with economical manufacture as a worth-while by-product.

Steel castings will make this combination available for your product, whatever you manufacture, with these important additions; easy machining, perfect alignment, rigidity, resistance to fatigue, simplified assembly through combining parts, and a wide selection of mechanical properties.

No other material you can specify can give you so many of the inherent advantages of steel, at so economical a cost. Steel castings will help you build a better, more modern, streamlined product—often at a lower total cost, which means a broader market.

For more information, see your local foundry, or write to Steel Founders' Society of America, 920 Midland Bldg., Cleveland, Ohio.

FOLLOW THE EXAMPLE OF THE AIRPLANE BUILDER — MODERNIZE YOUR PRODUCT WITH

STEEL CASTINGS

Defense Orders

(*Continued from page* 41)

plane engine program was revealed during a recent visit of W. S. Knudsen, director of OPM, to Detroit. The Wright Whirlwind being built by Continental develops 450 h. p. when used to power the 31-ton tanks as manufactured by Chrysler, Pullman-Standard Car Co., American Car & Foundry Co. and Lima Locomotive Co. Some engines will be shipped abroad for use in British tanks. The model for aircraft develops 400 h.p. and goes into training planes made by Vultee Aircraft, Inc.

Continental expects to reach a production rate of approximately 30 per day, or 600 a month, by fall. Present employment of 1200 workers will have grown to 3500 by that time.

At its Muskegon plant, Continental is making its own 250-h.p. radial engine for use in light 12-ton U. S. tanks and in training planes, automotive engines for ¼-ton Army "blitz buggies" and small plane engines. Continental Aviation & Engineering Co., a subsidiary, is working on a high horsepower engine for pursuit planes at its Detroit research laboratories.

Accompanying Knudsen on his Detroit tour, Maj.-Gen. George H. Brett, chief of the Army Air Corps, revealed that the Rolls-Royce liquid-cooled airplane engine, which Packard will produce, will be used to power a new type of pursuit plane developed by Curtiss.

Allison Division of GM has received additional orders for $49,866,000 for the 1350-h.p. liquid-cooled Allison engines which the Air Corps is using to power its Lockheed P-38, Curtiss P-40 and North American Apache pursuit planes. This brings total Allison orders to $242,000,000.

Ford has received a letter of intent for $106,000,000 for additional 2000-h.p. Pratt & Whitney airplane engines. Ford's new aircraft apprentice school with a capacity of 3000 students has moved into the front portion of the new airplane engine factory at the Rouge. Classes are being organized in machine shop, assembly, disassembly, inspection and testing of the aircraft engines.

Nash-Kelvinator has received a letter of intent for $15,150,744 to equip the plant at Lansing which was bought from Reo by the government to manufacture Hamilton Standard propellers. Allis-Chalmers Mfg. Co. has purchased a 20-acre site on the outskirts of Milwaukee where a $12,500,000 plant will be erected to make aircraft superchargers.

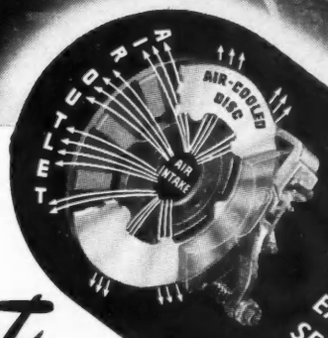
Approximately 1700 parts for Martin medium bombers will be manufactured by the Plymouth and DeSoto Division of Chrysler Corp. The parts will be used in the nose and center fuselage sections which Chrysler Corp. will supply as completely assembled units to the Glenn L. Martin-Nebraska Co.

One hundred millions in new orders for 1200 additional tanks were awarded during the last ten days of July with the largest share going to Chrysler Corp. for approximately 1600 28-ton tanks in two orders; one for $63,725,000, the other for $10,781,000. Other tank orders totalling over $14,000,000 went to American Car and Foundry Co., Berwick, Pa.

Sterling Engine Co. of Buffalo has received an order for the production of 250 12-cylinder 1200 horsepower Admiral engines for British torpedo boats.

General Motors has been awarded a supplementary contract for $27,823,000 for production of machine guns.

Other recent national defense orders include $1,987,000 to White Motor Co. for trucks; $851,717 to Yellow Truck & Coach Mfg. Co. for 2½-ton trucks; $5,020,283 to Autocar Co. for tractor trucks; $1,586,000 to Mechanics Universal Joint Division of Borg-Warner Corp. for fuses; $870,000 to Budd Mfg. Co. for shells; $502,150 to Electric Storage Battery Co. for battery assemblies; $1,500,000 to Delco-Remy Division of GM, Anderson, Ind., for generator assemblies; $524,000 to Delco-Remy Division, Rochester, Ind., for gun directors; $357,000 to Spark-Withington Co., Jackson, Mich., for landing gear warning assemblies and airplane signal mooring kits.



THE TRU-STOP "VENTILATED" DISC MAKES TRU-STOP EMERGENCY BRAKES SERVE BETTER AND LAST LONGER

YOU HAVE A BIG "STAKE" IN *Safer Transport*

Traffic is up. Highway accidents have increased over 16%. That is of vital concern to manufacturers of Motor Trucks and Buses.

So those who install TRU-STOP *Emergency* BRAKES on their equipment are meeting the situation by doing a good job of "selling" the added safety of their products. For good measure they "sell" the provable fact that their brake maintenance costs are less because the rugged, drop-forged, ventilated discs of "TRU-STOPS" give thousands of extra miles to emergency brake linings —and actually prolong the life of service brakes as well.

We will be glad to discuss these possibilities with you if you do not list TRU-STOP *Emergency* BRAKES as standard.

Today more new units are being delivered equipped with TRU-STOP *Emergency* BRAKES than at any other time.

TRU-STOP *Emergency* BRAKES

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AMERICAN CHAIN & CABLE COMPANY, Inc.

Mobilizing

(*Continued from page* 13)

motive industry as a whole, the remaining 10 per cent comprises principally the production of military trucks."

The total of General Motors' defense deliveries up to July amounted to $209,500,000, consisting mostly of Diesel engines, military trucks and Allison aircraft engines, for which basic manufacturing facilities were in existence or were under development at the start of the defense program. On the basis of the corporation's statistics, he predicts that it will be unable to get into peak defense production until toward the end of 1942, which is dependent upon the scheduled expansion of new manufacturing facilities.

Mr. Sloan lists management, administrative and technical, as the most important contribution that the industry can give to the defense program, but "the productive capacity—plants, machinery and essential equipment—must be created specifically for that purpose. These are not available except to a minor degree."

"Aside from the question of priority of materials, or however essential the objective might be," he states, "any reduction in the production of the automotive industry cannot possibly result in any measurable acceleration in the production of materials for national defense so far as General Motors operations are concerned. It will in all likelihood result in the temporary unemployment of large numbers of productive workers now employed by General Motors. The reason is simple. The plants under construction by General Motors, essential for producing the things needed for defense, are only just beginning to reach the point when they can absorb materials and employ workers. And other plants are just being started."

Gold Cup Championships At Red Bank August 16

The 1941 Gold Cup speedboat championships will be held at Red Bank, N. J., on Saturday, August 16, in conjunction with the National Sweepstakes regatta. When the Detroit Gold Cup Committee recently declined to stage the championships next September, Horace E. Dodge, Jr., representative of the Dodge Brothers Dealers Association, to whom sponsorship for this year's Gold Cup race was awarded by the American Power Boat Association last January, took advantage of an offer of the National Sweepstakes Regatta Association to hold the Gold Cup race on the Shrewsbury River at Red Bank. The three 30-mile heats of the Gold Cup race will be held on Saturday, as will also all heats for the 225-cu. in. class, which will leave these hydroplanes as well as the Gold Cup contestants free to enter the three 15-mile heats of the National Sweepstakes Trophy event to be held on Sunday afternoon.

Machine Tool Shipments Reach New High

Machine tool shipments during June increased to $63,400,000 as compared to $60,800,000 for May of this year and $34,000,000 for June 1940, according to the National Machine Tool Builders' Association. The entire production of the industry is going to either national defense enterprises or to aid for Britain.

Ninety-five per cent of the employes in the industry are employed in companies working two or three shifts, subcontracting is steadily increasing and programs for training new employes are in full swing.

Buda Celebrates 60th

The Buda Co., Harvey, Ill., recently celebrated its 60th anniversary. The company's original order, under the leadership of George Chalendar, was for railroad handcars. In 1891, just 50 years ago, the company moved to its present location in Harvey. In addition to its well-known line of gasoline and diesel engines the company still makes railroad equipment.

CENSORED

An exclusive feature prepared by the London correspondent of AUTOMOTIVE INDUSTRIES, M. W. Bourdon.

At the request of the Ministry of Supply, a joint committee representing the National Federation of Vehicle Trades and bus operators' organizations has been formed to draw up specifications for standard designs of single-deck and double-deck bus bodies for wartime production and use. All dealings in passenger vehicles seating 10 or more persons must now receive prior authorization by the Regional Transport Commissioners.

* * *

A national register is being prepared of trucks equipped for the salvaging and transport to repair shops of road vehicles damaged by accident or enemy action. A special label will facilitate their movement, if necessary, into and through areas temporarily closed to ordinary traffic.

* * *

W. E. Rootes has been appointed deputy chairman of the Supply Council of the Ministry of Supply and will act on behalf of Lord Beaverbrook, the Minister of Supply, in the latter's absence from meetings of the council. His major task will be to speed up tank production. He normally controls the activities of 18 motor manufacturing and distributing companies; and also is president of the Society of Motor Manufacturers and chairman of the Automobile Export Group, the Aero Engine Shadow Factory Group and the Motor Vehicle Maintenance Advisory Committee.

* * *

The Ministry of War Transport has ceased to publish figures of the monthly registrations of new vehicles in Britain, but manufacturers and traders who desire to have them, can get them by direct application to either the Ministry or the Society of Motor Manufacturers. Their publication is, however, strictly prohibited, even in exclusive trade journals.

* * *

E. L. Payton, hitherto deputy chairman and financial director of the Austin Motor Co., has been appointed chairman of the company following the death of Lord Austin. Payton was elected to the board of directors in 1922 and was largely responsible for the remarkable recovery of the Austin Co. from the financial difficulties in which it was involved for a while after the post-war slump of 1920.

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Perhaps you can't make deliveries, or you can't get materials, or you are concentrating on government orders—now.

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